STUDIES ON THE TEXTS OF THE DESERT OF JUDAH [78]

Head of All Years

Astronomy and Calendars at Qumran in their Ancient Context

JONATHAN BEN-DOV

BRILL

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Studies on the Texts of the Desert of Judah

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ABBREVIATIONS AND BIBLIOGRAPHICAL NOTES

ABBREVIATIONS

364DCT	364-day Calendar Tradition
364DY	364-day Year
ÄA	Ägyptische Abhandlungen
AB	Anchor Bible
AB	The Book of Astronomy, *1 Enoch* 72–82
ABD	*Anchor Bible Dictionary*
ABG	Arbeiten zur Bibel und ihre Geschichte, Leipzig
ACT	O. Neugebauer, *Astronomical Cuneiform Texts* (London: Humphries, 1955)
ADRTB I-V	H. Hunger and A. Sachs, *Astronomical Diaries and Related Texts from Babylonia*, (Vienna: Österreichische Akademie der Wissenschaften, 1988–2001)
AfO	*Archiv für Orientforschung*
AfOBei	AfO Beihefte
AGAJU	Arbeiten zur Geschichte des antiken Judentums und des Urchristentums
AHw	W. von Soden, *Akkadisches Handwörterbuch* (Wiesbaden: Harrassowitz, 1965–1981)
AJEC	Ancient Judaism and Early Christianity (formerly AGAJU)
ALD	Aramaic Levi Document
ANRW	*Aufstieg und Niedergang der Römischen Welt*, (Berlin: de Gruyter, 1972-1992)
ANTZ	Arbeiten zur neutestamentlichen Theologie und Zeitgeschichte
ANYAS	Annals of the New York Academy of Sciences
AOAT	Alter Orient und Altes Testament
BETL	Bibliotheca Ephemeridum Theologicarum Lovaniensium
Bib	*Biblica*
BN	*Biblische Notizen*
BZAW	Beihefte zur ZAW
BZNW	Beihefte zur Zeitschrift für die neutestamentliche Wissenschaft
CAD	*Chicago Assyrian Dictionary*
CBQ	*Catholic Biblical Quarterly*
CBQMS	Catholic Biblical Quarterly Monograph Series
CDA	*A Concise Dictionary of Akkadian*, ed. J. Black, A.R. George and N. Postgate (Wiesbaden: Harrassowitz, 2000)
CM	Cuneiform Monographs
CSCO	Corpus Scriptorum Christianorum Orientalis
DJD	Discoveries in the Judaean Desert
DSD	*Dead Sea Discoveries*

DSSR	*The Dead Sea Scrolls Reader*, ed. D.W. Parry and E. Tov (Leiden: Brill, 2004–2005)
EAE	*Enūma Anu Enlil*
EDSS	*Encyclopedia of the Dead Sea Scrolls*, ed. L.H. Schiffman et al. (Oxford: OUP, 2000)
EI	*Eretz-Israel*
EMLV	Expanded Model of Lunar Visibility (formerly the “Synchronistic Calendar”)
EstBib	*Estudios Bíblicos*
FAT	Forschungen zum Alten Testament
HALOT	*The Hebrew and Aramaic Lexicon of the Old Testament* (Leiden: Brill, 1999)
HAMA	O. Neugebauer, *A History of Ancient Mathematical Astronomy* (3 vols.; Berlin: Springer, 1975)
HdO	Handbuch der Orientalistik
HSMM	Harvard Semitic Museum Monographs
HSS	Harvard Semitic Studies
HTR	*Harvard Theological Review*
HUCA	*Hebrew Union College Annual*
IEJ	*Israel Exploration Journal*
IOS	*Israel Oriental Studies*
JANES	*Journal of the Ancient Near Eastern Society*
JAOS	*Journal of the American Oriental Society*
JEOL	*Jaarbericht Ex Oriente Lux*
JBL	*Journal of Biblical Literature*
JCS	*Journal of Cuneiform Studies*
JJS	*Journal of Jewish Studies*
JJTP	*Journal of Jewish Thought and Philosophy*
JNES	*Journal of Near Eastern Studies*
JQR	*Jewish Quarterly Review*
JRAS	*Journal of the Royal Asiatic Society*
JSHRZ	Jüdische Schriften aus hellenistisch-römischer Zeit
JSJ	*Journal for the Study of Judaism in the Persian, Hellenistic and Roman Period*
JSJSup	JSJ Supplement Series
JSOTSup	Journal for the Study of the Old Testament Supplement Series
JSP	*Journal for the Study of the Pseudepigrapha*
JSPSup	JSP Supplement Series
LAS II	S. Parpola, *Letters from Assyrian Scholars to the Kings Esarhaddon and Assurbanipal*, Part II: Commentary and Appendices (AOAT 5/II. Kevelaer and Neukirchen-Vluyn, 1983)
LBAT	T. Pinches et al., *Late Babylonian Astronomical and Related Texts* (Providence: Brown University Press, 1955)
LSJ	H.G Liddel and R. Scott, *Greek-English Lexicon* (Oxford: OUP, rev. 1996)
LSTS	Library of Second Temple Studies
NABU	*Notes assyriologiques brèves et utilitaires*
NTOA	Novum Testamentum et Orbis Antiquus
OBO	Orbis Biblicus et Orientalis

OLA	Orientalia Lovaniensia Analecta
OLZ	*Orientalische Literaturzeitung*
OTS	Oudtestamentische Studien
RA	*Revue d'assyriologie et d'archéologie orientale*
RB	*Revue biblique*
REJ	*Revue des etudes juives*
RlA	*Reallexikon der Assyriologie* (Berlin: de Gruyter, 1928–)
RO	Res Orientales
RQ	*Revue de Qumran*
RSR	*Recherches de science religieuse*
SAA	State Archives of Assyria
SBLEJL	Society of Biblical Literature – Early Judaism and its Literature
SBLSP	*Society of Biblical Literature Seminar Papers*
SCI	*Scripta Classica Israelica*
SJLA	Studies in Judaism in Late Antiquity
SJOT	*Scandinavian Journal of the Old Testament*
STDJ	Studies on the Texts of the Desert of Judah
SVTP	Studia in Veteris Testamenti Pseudepigrapha
TAPS	Transactions of the American Philosophical Society
ThLZ	*Theologische Literaturzeitung*
TSAJ	Texte und Studien zum Antiken Judentum
TZ	*Theologische Zeitschrift*
VSAO	Vergleichende Studien zu Antike und Orient
VT	*Vetus Testamentum*
VTSup	VT Supplement Series
WMANT	Wissenschaftlische Monographien zum Alten und Neuen Testament
WZKM	*Wiener Zeitschrift für die Kunde des Morgenlandes*
ZA	*Zeitschrift für Assyriologie*
ZAH	*Zeitschrift für Althebraistik*
ZDPV	*Zeitschrift des deutschen Palästina Vereins*

BIBLIOGRAPHICAL NOTES

Cuneiform

Abbreviations not noted in the list above follow the practice employed in CAD. The name of the main astronomical compendium in cuneiform is given as Mul.Apin, although other modes of representation may be equally valid: ^{mul}Apin, mul.apin, etc. The choice of this particular transliteration is strictly conventional.

SAA VIII = H. Hunger, *Astrological Reports to Assyrian Kings* (Helsinki: University of Helsinki Press, 1992).
SAA X = S. Parpola, *Letters from Assyrian and Babylonian Scholars* (Helsinki: University of Helsinki Press, 1983).

Bible

Bible quotations follow the NJPS version.

Unless otherwise indicated, quotations and translations of Qumran literature follow DJD (Oxford: Clarendon). While readings from DJD XXI have been maintained, several new translations have been employed.

DJD VII = M. Baillet, *Qumrân Grotte 4 III (4Q482–4Q520)*, 1982.
DJD X = E. Qimron and J. Strugnell, *Qumran Cave 4 V. Miqṣat Maʿaśe Ha-Torah*, 1994.
DJD XI = J. VanderKam and M. Brady (consulting editors), *Qumran Cave 4 VI. Poetical and Liturgical Texts, Part 1*, 1998.
DJD XXI = S. Talmon, J. Ben-Dov and U. Glessmer, *Qumran Cave 4 XVI. Calendrical Texts*, 2001.
DJD XXII = J. VanderKam (consulting editor), *Qumran Cave 4 XVII. Parabiblical Texts, Part 3*, 1996.
DJD XXVI = P.S. Alexander and G. Vermes, *Qumran Cave 4 XIX. Serekh Ha-Yaḥad and Two related Texts*, 1998.
DJD XXVIII = D.M. Gropp, *Wadi Daliyeh II*; J. VanderKam and M. Brady (consulting editors), *Qumran Cave 4 XXVIII. Miscellanea, Part 2*, 2001.
DJD XXXIV = J. Strugnell, D.J. Harrington, T. Elgvin, *Qumran Cave 4 XXIV. Sapiential Texts, Part 2: 4QInstruction (Mûsār lĕ-mēvîn): 4Q415 ff*, 1999.
DJD XXXV = J.M. Baumgarten et al., *Qumran Cave 4 XXV. Halakhic Texts*, 1999.
DJD XXXVI = S.J. Pfann, *Qumran Cave 4 XXVI. Cryptic Texts*; J. VanderKam and M. Brady (consulting editors), *Miscellanea, Part 1*, 2000.
DJD XXXIX = E. Tov (ed.), *The Texts from the Judaean Desert: Indices and an Introduction to the* Discoveries in the Judaean Desert *Series*, 2002.

PSEUDEPIGRAPHA
Translations of *1 Enoch* generally follow G.W.E. Nickelsburg and J.C. VanderKam, *1 Enoch* (Minneapolis: Fortress Press, 2004). Modifications of this version are found mainly in chapter 2.

The Ethiopic text of *1 Enoch* was consulted according to the edition by M.A. Knibb, *The Ethiopic Book of Enoch* (Oxford: Clarendon, 1978), together with the variant readings in the *apparatus criticus*, especially the useful register of variant readings from ms Tana 9.

Transliterations of Geez words follow W. Leslau, *Concise Dictionary of Geʿez* (Wiesbaden: Harrassowitz, 1989).

Quotations and translations of the *Book of Jubilees* follow J.C. VanderKam, *The Book of Jubilees* (CSCO 510; Leuven: Peeters, 1989).

TABLES
In the TABLES, the years are marked in Arabic and the months in Roman numerals.

INTRODUCTION

The present study examines a remarkable cultural phenomenon—the Jewish year of 364 days and the scholarly tradition in which this concept came to be embodied during the Second Temple period. The fortunate findings in the caves near the Dead Sea have opened a window on a significant intellectual junction, which bears both on the history of Jewish ideas and the general history of Science. The substantiation of this statement leads us on a long journey through various branches of religious and scientific writings—Jewish and non-Jewish—calendrical, astronomical, and theological in nature. Some of the texts require a substantial measure of codicological and philological "clearing of the way" before they may be incorporated into the wider context. This applies principally to the Astronomical Book (AB), now a part of *1 Enoch*, which possesses an elaborate history of composition and transmission.

The very presence of an astronomical treatise in Second Temple Jewish sources is somewhat unexpected, this cultural realm frequently having been considered to be dominated by a covenantal and nomistic discourse. Indeed, modern scholars often dismissed the Enochic astronomical teaching as "primitive." The present volume sets out to demonstrate that the Jewish scientific tradition in fact constituted an integral part of the astronomical knowledge current in the Ancient Near East during the Persian and early Hellenistic periods. In a quite natural fashion, the emulation of this knowledge in Jewish circles led to a new synthesis, perceptibly different from the main streams of astronomical teaching existent in Babylonia, Greece, Egypt, and India. In consequence, the Jewish astronomical tradition should be regarded as a self-contained intellectual construct requiring examination both "from within"—tracing the lines of coherency along the tradition's various manifestations, and "from without"—via a comparative study with non-Jewish sources.

The present study discusses the Jewish attestations of the 364-day calendar tradition—primarily comprised of the Astronomical Book in *1 Enoch* and the calendrical texts from Qumran—together with pertinent material from Mesopotamia: the astronomical compendium Mul.Apin, the divinatory series *Enūma Anu Enlil* (EAE), and later non-mathematical astronomical texts. Many other related documents are also considered along the way. Our primary aim is to achieve a synthesis of this variegated subject matter by initially mapping it and subsequently suggesting lines of development in historical context. Our intention is not to present a handbook of the Qumran calendar or the *mišmarot* texts but an in-depth study of the main representations of the tradition, special emphasis being laid on astronomical concepts. Nor do we relate directly to the pressing question of the origin of the Jewish 364-day year: was it first practiced in the (post-)exilic period or was it an invention of apocalyptic circles in the third century B.C.E.? Was it employed in the Temple throughout the Persian and Hellenistic periods—or did it in fact constitute an ideal structuring of Time never implemented in practice?[1] The present author generally tends to practice caution with regard to the existence of the 364DY prior to its first literary attestations—i.e., in the third-century B.C.E. For a summary of the calendars at Qumran the reader is referred to several studies published in recent years.[2]

As each of the present Chapters relates to a distinct field of learning, no integrative survey of scholarship will be offered at this point. For a review of the research, the reader is referred to the respective Chapters.

0.1 Calendars, Astronomy, and Cosmology

The title "Qumran calendars" does not sufficiently account for the material under investigation here. This phrase should rather be modified by the addition of the term "astronomy," in order to better

[1] These questions were posed in two articles by VanderKam, which remain the benchmarks in the field, whether or not one concurs with his conclusions: see J.C. VanderKam, "The Origin, Character and Early History of the 364-Day Solar Calendar: A Reassessment of Jaubert's Hypotheses [1979]" and "2 Maccabees 6, 7a and Calendrical Change in Jerusalem [1981]," both collected in idem, *From Revelation to Canon: Studies in the Hebrew Bible and Second Temple Literature* (JSJSup 62; Leiden: Brill, 2000), 95–127.

[2] J.C. VanderKam, *Calendars in the Dead Sea Scrolls: Measuring Time* (London: Routledge, 1998); U. Glessmer, "Calendars in the Dead Sea Scrolls," in *The Dead Sea Scrolls After Fifty Years* (ed. P.W. Flint and J.C. VanderKam; Leiden: Brill, 1999), 2:213–78; J. Ben-Dov, "The 364-day Year in Qumran and the Pseudepigrapha," in *'Al Megillot Qumran* (ed. M. Kister; Jerusalem: Yad Ben Zvi, forthcoming) (Hebrew).

define the interests of the ancient authors. Naturally, one must be cautious regarding terminological issues, since ancient authors were unaware of the terms—not to speak of the intricate methods—which modern authors employ to identify the genres present within ancient literature. A strict implementation of this argument, however, is likely to undermine the whole modern discourse regarding the classification of texts. Some form of terminology must be adopted, and the primary prerequisite lies in the demand that the modern scholar remain loyal to the intentions of the text and refrain from imposing upon it his or her modern perspective.

In this sense, the term "calendar" is misleading—both in its unwarranted emphasis on the administrative aspect of the material and its failure to recognize the intellectual and cosmological interests of the ancient authors. In modern scholarship, the term "calendar" is frequently used with regard to the clerical administration of various procedures—whether civil or cultic-religious—whose execution is often detached from actual scientific knowledge.[3] While the administration of cultic duties is certainly an interest of the Qumran authors, it by no means constitutes their only preoccupation. Such texts as AB and 4Q317 do not mention administrative or cultic assignments at all. The authors of the "calendrical" texts were in fact far more interested in the harmony created by the conduct of the heavenly luminaries. Tracing and appreciating this harmony required a measure of astronomical and arithmetic capability.

To say this does not mean that the Jewish discipline discussed here was committed to the standards of observation and prediction adopted in other contemporary cultures. On the contrary: the Jewish texts gradually became detached from observation and inclined towards over-schematization. It is nonetheless widely acknowledged in present-day scholarship that the positivistic-oriented definitions of "science" and "astronomy" employed in the past must give way to wider definitions, admitting much additional pre-modern cosmological speculation into the scientific circle.[4] We choose to

[3] See, for example, the distinctions drawn by D. Brown, *Mesopotamian Planetary Astronomy-Astrology* (CM 18; Groningen: Styx, 2000), 195–97.

[4] See chiefly F. Rochberg, *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture* (Cambridge: Cambridge University Press, 2004), 14–43, 287–99.

follow the requirements posited by Philip Alexander according to which an ancient composition may be said to qualify as "science": [5]

> An explicit or implicit assumption exists that nature is regular and is governed by immutable laws which are accessible to the human mind.
>
> An attempt to produce a rational model of the physical world which reduces the bewildering complexities of natural phenomena to a limited number of underlying primary elements or to the operation of a small number of fundamental laws.
>
> The involvement, whether explicitly or implicitly, of a significant element of direct observation of the physical world.

According to this definition, a significant part of the "calendrical" corpus from *1 Enoch* and Qumran must be recognized as representing an essentially scientific interest on the part of the authors, themselves serving as the transmitters of an earlier scientific tradition.

Within the broad field of astronomy, special focus is dedicated in the present volume to lunar data and the status of the moon in the sectarian calendar-reckoning. Whereas earlier scholarship tended to view the calendar polemics as represented in Second Temple literature as a conflict between pro-solar (sectarian) and pro-lunar (proto-rabbinic) factions,[6] this theory fails to account for the abundant literature on lunar visibility contained within the 364-day calendar tradition. Within this discipline, opposing statements are encountered with respect to the value of the moon in time-reckoning, the *Book of Jubilees* standing out as the primary—probably the sole—representative of anti-lunar polemics. In contrast, other parts of the tradition treat the moon as a matter-of-fact indicator of cosmological order.

[5] P.S. Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," in *The Wisdom Texts from Qumran and the Development of Sapiential Thought* (BETL 159; ed. C. Hempel, A. Lange, and H. Lichtenberger; Leuven: Peeters and Leuven University Press, 2002), 224.

[6] This view is best represented by Shemaryahu Talmon in his seminal article from 1958 and again recently in *EDSS* 1:108–17. Talmon's view has recently been endorsed by R. Elior, *The Three Temples: On the Emergence of Jewish Mysticism* (trans. by D. Louvish; Oxford and Portland: Littman Library of Jewish Civilization, 2004).

A proper evaluation of the calendar texts indicates that the 364-day year does not relate—as has commonly been assumed in past scholarship—to a "solar year" but to a schematic year, be this a Sabbatical, as sometimes held, or, more neutrally, a "364-day" year.[7] In AB—the cornerstone of the Jewish 364-day calendar tradition—the schematic year is intended to account for the orbits of *all* the heavenly luminaries, including the moon and stars. Likewise, once the 364DY was assimilated into the religious sectarian discourse, the most venerated aspect of the year became its arithmetical perfection and symmetry. As a consequence, in many sources the year is neither solar nor lunar or stellar but strictly a schematic measurement bearing the stamp of divine instruction.

The "lunar question" reaches its peak in 4Q320, 4Q321, and 4Q321a, wherein the lunar lists form the very heart of the Qumran calendar reckoning. What constitutes the proper way to evaluate the interconnectedness of the lunar data with the 364-day year? Two scholarly positions have been proposed (summarized in Chapter 5), both of which seek a solution to the problem solely in the calendrical realm. The prevalent view (VanderKam et al.) takes these scrolls as evidence that a lunar calendar was practiced in sectarian circles alongside the 364DY. The minority view (Talmon and Knohl) sees in the lunar rosters of 4Q320 and 4Q321 a means of depreciating the calendrical value of the moon—due to its unstable distribution of light—and endorsing the exclusivity of the "solar" calendar. To the extent that they fail to take account of the ancient authors' astronomical interest, however, both these views are methodologically inadequate. The present work, in contrast, suggests that the calendrical texts also contain non-cultic elements. Whereas the normative calendar throughout the Qumran literature is the 364DY, lunar data were preserved alongside the latter in order to supplement the overall cosmological picture. While the lunar data bear indispensable scientific value, they do not relate to the cultic norms embodied in the sacred 364DY.

[7] On this point we follow, with certain reservations, Glessmer and Albani: see Glessmer, "Calendars in the Qumran Scrolls," 231; M. Albani, "Zur Rekonstruktion eines verdrängten Konzepts: Der 364-Tage-Kalender in der gegenwärtigen Forschung," in *Studies in the Book of Jubilees* (TSAJ 65; ed. M. Albani, J. Frey, and A. Lange; Tübingen: Mohr Siebeck, 1996), 79–125.

The acknowledgement of the value of "mere" astronomical data derives from what we term the "cosmological imperative" in Jewish apocalyptic circles of the Second Temple period. In most Jewish circles of that time and earlier, cosmological speculation was regarded at best indifferently and at worst pejoratively. In contrast, apocalyptic circles encouraged their members to engage in the study of nature as part of their religious outlook. The Epistle of Enoch thus rhetorically asks:

> … who is there of all men who is able to look at all the works of heaven? … Or to ascend and see all their ends, and to consider them or make (something) like them? Or who is there of all men who is able to know what is the width and length of the earth; and to whom has the size of all them been shown? …[8]

As Michael Stone has noted, this type of question is already found in biblical literature, being especially prominent in the wisdom speeches in the Book of Job (38–39). Contrary to Job, however, the author of the *Epistle of Enoch* adopts an optimistic stance with respect to the human capacity to answer such questions affirmatively.[9] Enoch constitutes the prime example of a human being who ascended to heaven, was taught all the mysteries of heaven, and transmitted them to his human descendants in a book (*1 Enoch* 68–69, 81). While earlier authors condemn the practice of observing the heavenly luminaries (Deut 4:18–19; Job 31:26–28), and warn the scribe against revealing too many of the world's mysteries (Sir 3:21–22), the general stance of the Enochic writers (the Book of the Watchers, the

[8] *1 En* 93:11–14, quoted according to G.W.E. Nickelsburg and J.C. VanderKam, *1 Enoch: A New Translation* (Minneapolis: Fortress, 2004), 143. While this passage appears in the Ethiopic text as the conclusion to the Apocalypse of Weeks (93:1–10), its position there seems to be secondary. The removal of the passage from its original place appears to lie behind the serious divergences between the Aramaic and Ethiopic texts. The explicit statement in 93:10 on "sevenfold teaching concerning his whole creation" is not attested in the Aramaic and would appear to be a secondary harmonization of the verse with the cosmological content of vv. 11ff: see G.W.E. Nickelsburg, *1 Enoch 1* (Hermeneia; Minneapolis: Fortress, 2001), 451ff.

[9] See M.E. Stone, "Lists of Revealed Things in the Apocalyptic Literature," in *Magnalia Dei: Essays on the Bible and Archaeology in Memory of G. Ernest Wright* (ed. F.M. Cross et al.; NY: Doubleday, 1976), 414–52.

Astronomical Book, the Epistle of Enoch, and the Book of Parables) is quite the opposite.[10] This attitude is also reflected in *4 Ezra*.

The cosmological imperative drove the early apocalyptic authors to collect and preserve the fragments of Mesopotamian teachings available to them. It is to this fortunate circumstance that we owe the preservation of scientific material, some of it unattested elsewhere. Although not strictly apocalyptic, the group which later produced the calendrical texts maintained this cosmological interest by incorporating astronomical concepts into its cultic calendars.[11]

0.2 Authorship, Tradition, and Rewriting

The variety of sources discussed in the book may be grouped into several scholarly traditions, each of which focuses on a significant text(s), its/their copying, and the production of further literature related to it/them. Somewhat paradoxically, a living scholarly tradition is never satisfied with the material received from earlier scholars but constantly strives to rework and update it—either in new versions of the original or in novel compositions dependent upon it.[12] Research into the relevant material thus faces the acute problem of distinguishing between such entities as:

[10] Anette Yoshiko Reed downplays the importance of this attitude, claiming that "… the speculative stance of the Astronomical Book and the majority of the Book of the Watchers does not look so different from the skeptical stance of Qohelet and Ben-Sira" (*Fallen Angels and the History of Judaism and Christianity: The Reception of Enochic Literature* [Cambridge: Cambridge University Press, 2005], 43). It is difficult to deny the significant differences in systematization and the amount of details between the cosmological statements in Qohelet and the Book of Watchers or AB, however—a disparity which makes Reed's conclusion difficult to accept.

[11] The interest in cosmology as attested in the Qumran calendars should therefore be added to the list of apocalyptic elements in Qumran literature. This component is absent from J.J. Collins' handbook, *Apocalypticism in the Dead Sea Scrolls* (London/NY: Routledge, 1997). The chapter on "The Heavenly World" in this volume (pp. 130–49) focuses solely on *merkavah* visions and angelology and does not mention cosmology or science.

[12] This cultural phenomenon is best depicted by Michael Fishbane and his school: see M. Fishbane, *Biblical Interpretation in Ancient Israel* (Oxford: Clarendon, 1985); B.M. Levinson, "'You Must not Add Anything to what I Command You': Paradoxes of Canon and Authorship in Ancient Israel," *Numen* 50 (2003): 1–51.

An authoritative text

Copies, as opposed to rewritings, of the authoritative text

Compositions from the same literary tradition as the authoritative text

Such conceptual—some would say merely terminological—distinctions are especially problematic with regard to the early Enochic compositions, whose codicological, ideological, and sociological data are only now beginning to be explored.[13] They are even more taxing with regard to the Astronomical Book, whose development and textual versions are even more obscure. These circumstances suggest that a wider comparative scope can profitably be applied. If we cannot sufficiently grasp the significance of the astronomical activity performed by the early Enochic school, analogous activity in slightly preceding or subsequent traditions may well prove helpful.

The earliest tradition encountered in the present volume focuses upon the pre-mathematical astronomical texts Mul.Apin and EAE 14. Themselves recapitulations of earlier knowledge, these were further edited and circulated by scholars in the Neo-Assyrian period.[14] During that time frame and beyond, the practice of copying of the central texts existed side by side with the creation of newer compositions based on them and written in their spirit. Prominent examples are such texts as the *Diviner's Manual* and the mystical series i.NAM.giš.ḫur.an.ki.a.[15] In addition, several commentaries on EAE 14 existed and circulated.[16] Although at times these compositions quote

[13] See most recently, G. Boccaccini and J.J. Collins (eds.), *The Early Enochic Literature* (JSJSup 121; Leiden: Brill, 2007).

[14] For the scholarly *Sitz im Leben* during that period, see U. Koch-Westenholz, *Mesopotamian Astrology: An Introduction to Babylonian and Assyrian Celestial Divination* (Copenhagen: The Carsten Niebuhr Institute of Near Eastern Studies, 1995), 56–73; Brown, *Mesopotamian Planetary Astronomy-Astrology*, 33–52.

[15] C. Williams, "Signs from the Sky, Signs from the Earth: The Diviner's Manual Revisited," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 473–85; A. Livingstone, *Mystical and Mythological Explanatory Works of Assyrian and Babylonian Scholars* (Oxford: Clarendon, 1986), 23–29, 38–44.

[16] F.N.H. Al-Rawi and A. George, "Enūma Anu Enlil XIV and Other Early Astronomical Tablets," *AfO* 38–39 (1991/1992), 63–66; E. Frahm, "Royal

passages from the foundation texts, their central engagement lies with the elaboration and extrapolation of these into further fields. Formally speaking, the account of schematic astronomy in the Astronomical Book of *1 Enoch* is an offshoot of the same scholarly tradition. We discuss the degree of affinity between Mul.Apin and the Enochic text in detail in Chapter 4.

Within the cultural realm of Judaea, the Astronomical Book functioned as a foundation document for a new scholarly tradition. While the products of the latter were, first of all, various copies of AB such as those found at Qumran,[17] perpetuators of the tradition also occupied themselves in rewriting, adapting, abridging, and compiling AB—or parts of it. This practice should not surprise us, since a similar process is known to have taken place with respect to the Hebrew Bible, both at Qumran and elsewhere.[18] Brooke has even argued that, "… just as the existence of the rewritten scriptural texts shows that some works were of increasing scriptural authority, so the inclusion of some rewritten scriptural texts amongst those with authority in their own right gave permission for the whole enterprise of rewritten scriptural compositions."[19]

The extensive rewriting of AB—parts of which are now hopelessly truncated—has resulted in the chaos which confronts present-day readers of this text. While a certain extent of the textual corruption is undoubtedly due to the later transmission of the text by Ethiopic scribes, an examination of the Aramaic fragments discovered at Qumran reveals that much of the reworking was already executed in the early stages of transmission. In Chapter 2, we assess the testimony of these textual witnesses in regard to AB's fluid textual identity.

The textual activity centred upon AB produced not only copies and revisions but also numerous novel compositions which elaborate on (some of) the themes of the foundation text. Such texts are 4Q503 and possibly 4Q334, both of which extend the lunar theory propounded in

Hermeneutics: Observations on the Commentaries from Ashurbanipal's Libraries at Nineveh," *Iraq* 66 (2004): 45–50.

[17] J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976), 273–97.

[18] See G.J. Brooke, "The Rewritten Law, Prophets and Psalms: Issues for Understanding the Text of the Bible," in *The Bible as Book: The Hebrew Bible and the Judaean Desert Discoveries* (London: British Library, 2002), 31–40.

[19] Brooke, "The Rewritten Law, Prophets and Psalms," 37.

AB into the field of liturgy. The cryptic scroll 4Q317 constitutes another significant example of the rewriting and extrapolation of AB. Taken together, the evidence of intense scholarly activity focused on the old versions of AB suggests that this text formed an authoritative document in the eyes of a significant scholarly circle. The activity of this circle commenced in pre-sectarian times and subsequently became part of the curriculum of the sectarian scribes who settled at Qumran.

Given that AB constituted the central authoritative text—itself being an offshoot of Mesopotamian learning—and that very little, if any, biblical teaching is embedded in the astronomical tradition reflected at Qumran, it must be asked how much of this discipline is Jewish in nature. What, in other words, is the respective share of Mesopotamian and Jewish elements in the unique cultural amalgam created by this astronomical discipline? Such a question arises on every occasion of intercultural loaning, since transmitted knowledge is clearly not simply "borrowed" by one culture from another but worked into the texture of the receiving culture. The degree of association with the source-culture can naturally be expected to recede over the course of time. In the present case, AB indeed seems more universal and less essentially Jewish in nature than the calendrical texts from Qumran, in which Jewish priests and festivals already play a central role. What, if any, distinct Jewish elements be identified in AB and what remains of the Mesopotamian source in the calendrical texts? These questions are dealt with at length in Chapters 4–5 below.

The final issue to be addressed concerns the question of whether all the Jewish authors who incorporated references to the 364-day year in their writings belonged to the same tradition. Earlier stages of scholarship answered this question *a priori* in the affirmative. The following quotations from Talmon are characteristic:

> The major features of the Qumran ephemeris are identical with those of the solar calendar propagated in *1 Enoch* … and *Jubilees*.
>
> Minor discrepancies between the covenanters' calendar and the *1 Enoch/Jubilees* ephemeris may have arisen from … scribal mistakes … incomplete understanding … or inaccurate renditions …

> A stemmatic arrangement of passages in the Damascus Document brings to the fore the dependency of the covenanters' calendrical system on the calendar propagated by *Jubilees* and the latter's dependency on *1 Enoch*.[20]

More recently, however, it has been claimed that the degree of divergence attested by the Qumran finds proves the existence of multiple 364-day calendar traditions. This notion was first raised by Callaway and significantly buttressed by Glessmer.[21] Callaway called attention to the different traditions regarding the number of days in the year—360 or 364; to the presence or absence of priestly courses in each of the sources; and to the different sets of festivals recorded in the various calendrical scrolls and related texts. Glessmer added an argument regarding the different evaluation of the moon in *Jubilees* as opposed to other calendrical texts. According to these two authors, the sources attest not to one stable 364-day calendar tradition but to several such traditions, each creating its own discrete textual practice. In contrast, we tend to view the various sources as part of a contiguous tradition. Part of our present task therefore involves addressing the challenges posed by Callaway and Glessmer. We suggest that the different sets of festivals reported in the *mišmarot* corpus do not necessarily point to disagreements but simply reflect different usages of the lists. We discuss the relation between the 360- and 364-day year in detail in Chapter 1, pointing to the persistence of both numbers within one fairly stable calendar tradition. Finally, since the questions raised by *Jubilees* are exceptionally pressing, we endeavour to account for this text's calendrical peculiarities by demonstrating the book's idiosyncrasies, as well as the literary restraints imposed upon an author attempting to rewrite a biblical account.[22] We adopt the working hypothesis that the astronomical and calendrical texts belong

[20] Talmon, *EDSS* 1:112, 114.

[21] P.R. Callaway, "The 364-day Calendar Traditions at Qumran," in *Mogilany 1989: Papers on the Dead Sea Scrolls Offered in Memory of Jean Carmignac* (ed. Z.J. Kapera; Krakow: Enigma, 1993), 1:19–29; Glessmer, "Calendars in the Dead Sea Scrolls," 231. Stephen Pfann defended this view in his presentation at the Fourth Enoch Seminar in Camáldoli, Italy, July 2007.

[22] See below 3.6, and in greater detail, J. Ben-Dov, "Tradition and Innovation in the Calendar of Jubilees," in *Enoch and the Mosaic Torah: The Evidence of Jubilees* (ed. G. Boccaccini; Grand Rapids: Eerdmans, forthcoming).

to one continuous tradition, allowing for its occasional updating and refashioning.

Notwithstanding the obvious difficulties which arise from the astronomical and calendrical materials, this field constitutes fruitful ground for research regarding the primary questions facing scholars of Second Temple literature: the apocalyptic state of mind; the authority and textual identity of biblical and extra-biblical texts; and modes of transmission of knowledge between various scribal institutions.

0.3 Late Cuneiform Culture and the History of Science

Mark Geller wrote in 1997:

> It is therefore possible that Mesopotamian culture survived far longer than anyone has previously realized … Several witnesses attest to the survival of cuneiform up to the third century AD.[23]

The term "survival" here is problematic. Although Geller is evidently interested in locating the final cuneiform reader within Mesopotamia, much of Mesopotamian teaching outside Mesopotamia existed not in cuneiform but in vernacular languages and local scripts—as Geller himself notes. Mesopotamian elements constituted an important factor in the growth of a variety of later cultural disciplines. The persistence of elements from cuneiform culture into other cultures of the ancient world has attracted enormous scholarly attention over the years. Numerous such features have been collected from a variety of later texts in a compendium edited by Stephanie Dalley, as well as in the rich database of the Melammu project.[24]

The special role played by astronomy and astrology in the Mesopotamian cultural heritage is now an established scholarly fact. Although astronomy and astrology were expressed in cuneiform as late as the first century C.E., they exercised a far greater influence when translated and assimilated into cultures outside Mesopotamia—Persia, India, Greece, Rome, and, of course, Egypt. The scholar most responsible for identifying and clarifying this cultural borrowing was

[23] M.J. Geller, "The Last Wedge," *ZA* 87 (1997), 46, 63.

[24] S. Dalley (ed.), *The Legacy of Mesopotamia* (Oxford: Oxford University Press, 1998); for the Melammu database, see http://www.aakkl.helsinki.fi/melammu/ (checked 17.12.2007).

the late David Pingree, who summarized his findings in an article in 1998 and in scattered notes throughout his 1999 Handbook.[25] Much progress has been achieved since Pingree's studies, especially with regard to the astral sciences in Egypt. This advance is due to the discovery of numerous new documents in Demotic, as well as to the publication of the astronomical papyri from Oxyrhynchus.[26]

Questions concerning the method, date, and media through which the scientific knowledge was transmitted from Babylonia to the rest of the world have not yet been satisfactorily raised or answered. Scholarship has generally been content to focus on the role such individuals as Berossus and Hipparchus played in the transfer of knowledge from Babylonia to Greece and Egypt. Other personalities mentioned in this context appear to be more legendary than real.[27] The amount of material transmitted westwards—and its accuracy and popularity—cannot be accounted for by the activity of isolated individuals, however. The extent of the material attests to a far more intensive transmission—a phenomenon which also demands greater knowledge concerning the media through which it was communicated. Furthermore, the diffusion of knowledge is very meagrely attested in textual finds prior to the wealth of papyrus material from Roman Egypt.

In this perspective, the Jewish texts represented by *1 Enoch* and the Dead Sea Scrolls—which are frequently dismissed by modern scholars as primitive or irrelevant—possess particular importance. A prerequisite for acknowledging this fact is a reinterpretation of the astronomical content of the Jewish documents vis-à-vis their Mesopotamian cognates. Such a clarification is proposed in the

[25] D. Pingree, "Legacies in Astronomy and Celestial Omens," in *The Legacy of Mesopotamia* (ed. S. Dalley; Oxford: Oxford University Press, 1998), 125–37; H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (HdO I, 44; Leiden: Brill, 1999).

[26] Many of the new insights are collected in the forthcoming volume edited by D. Brown, *The Interaction of Ancient Astral Science* (Bremen: Hempen). With regard to Egypt, it is becoming increasingly clear, firstly, that the indigenous Egyptian tradition possessed far greater divinatory and astronomical capabilities than previously assumed. Secondly, it is evident that the originally Babylonian Systems A and B exerted great influence in Roman Egypt even subsequent to Ptolemy. For the former, see partially A. von Lieven, "Divination in Ägypten," *Altorientalische Forschungen* 26 (1999): 77–126; for the latter, see Rochberg, *The Heavenly Writing*, 34–35.

[27] See recently, J.F. Quack, "Les mages Égyptianisés: Remarks on Some Surprising Points in Supposedly Magusean Texts," *JNES* 65 (2006): 267–82.

present monograph (Chapters 4–5), as well as in several important recent articles by Henryk Drawnel.[28] Once this task has been accomplished, the relevance of the Jewish material for the history of science becomes evident.

Thematically, the Enochic and Qumran texts constitute some of the closest parallels known in world literature to Mul.Apin. Several parallels to later lunar texts from Mesopotamia are also attested, discussed in Chapter 5. From a chronological perspective, the Jewish material is dated to the third–first centuries B.C.E. This crucial period for the history of science has unfortunately been sparsely documented.

What appears to be an important aspect of the Jewish material is the language in which it is written: it is largely composed in Aramaic. Although the role of Aramaic as a potential medium for cultural transmission has long been noted, its attestation in the genre of scientific writing has been virtually non-existent up until now. In a recent article, Paul-Alain Beulieu has summarized the relations between Akkadian and Aramaic.[29] He concludes that, while certain scientific terms from Akkadian can be located in later Aramaic literature, no translation of full compositions was conducted. In our view, the closest we get to the translation of Akkadian science into Aramaic is in the Astronomical Book. When due attention is given to this composition—as well as to other Aramaic texts from Qumran—their importance as representations of a missing link between Mesopotamia and the West may be recognized.

Finally, a remote link in the chain of transmitted scientific knowledge is the neglected Ethiopic astronomy, a "stepchild" in the study of the history of science. Publications in this field consist primarily of a short monograph by Neugebauer and a handful of articles.[30] Having developed out of a merger between Enochic

[28] H. Drawnel, "Priestly Education in the *Aramaic Levi Document (Visions of Levi)* and the *Aramaic Astronomical Book* (4Q208–211)," *RQ* 22 (2006): 547–74; idem, "Moon Computation in the *Aramaic Astronomical Book*," *RQ* 23 (2007): 3–41. I am indebted to Dr. Drawnel for making his material available to me before publication.

[29] P.A. Beulieu, "Official and Vernacular Languages: The Shifting Sands of Imperial and Cultural Identities in First-Millennium B.C. Mesopotamia," in *Margins of Writing, Origins of Cultures* (The University of Chicago Oriental Institute Seminars 2; ed. S.L. Sanders; Chicago: Oriental Institute, 2006), 187–216.

[30] O. Neugebauer, *Ethiopic Astronomy and Computus* (Österreichische Akedemie der Wissenschaften, philosophisch-historische Klasse, Sitzungsberichte 347; Vienna:

astronomy and some Alexandrian elements, this discipline constitutes the true vehicle through which the astronomical teaching of *1 Enoch* has been preserved. Given its own poor state of preservation, it is not impossible that some of the material which vanished from AB was maintained by traditional Ethiopic scholars. Although the present monograph is by no means a general survey of Ethiopic astronomy—a worthy task in its own right—it does contain occasional references to the traditional Ethiopic concepts as reported by Neugebauer.

0.4 General Features of the 364-day Year

In this section, we present a brief summary of the main features of the 364DY. Many of the points outlined here are discussed in great detail later in the volume and are brought at this juncture for the convenience of the lay reader.[31]

The main feature of the 364-day year lies in its arithmetical simplicity. The year comprises twelve schematic months, with the beginning of the first month ideally concurring with the spring equinox. Thus the festival of Pessah, for example, always falls in the first rather than in the seventh month of the year. The year is divided into four equal quarters of 91 days called *tequfot* (sg. *tequfah*). Each quarter comprises three months, measuring 30, 30, and 31 days respectively.

Months are not named—either by the Canaanite names known from the Bible (*ziw*, *bwl*, ᵓ*etanim*, etc.) or according to the Babylonian names adopted in late biblical books (Tišri, Marḥešwan, etc.)—but are designated by ordinal numbers: the first month, the second month, etc. This is also the practice employed in priestly sources of the Pentateuch—as in the festival legislation in Leviticus 23–24 and Numbers 28–29, for example.

The 31-day month should be seen as a combination of 30 days + one day added at the end of the quarter. Four additional days—one at the end of each quarter—constitute the essential difference between the ideal 360-day year (12 x 30) and the 364-day year.

ÖAW, 1979), with references to several articles by S. Grébaut published between 1919 and 1923.

[31] For full surveys of the 364DY, see the articles quoted above in note 2.

In addition to the division of months and seasons, the year is also precisely divided into fifty-two weeks. Many sources make use of the convenient division into weeks, especially the *mišmarot* calendars, which divide the year—or rather the entire sexennial cycle—according to the weeks of service of the priestly courses in the Temple. Each quarter contains thirteen weeks—a number which also appears in the 13-week liturgical order of the "Songs of the Sabbath Sacrifice." Since the days of the year are neatly divided by seven, once the beginning of the year is declared on a specific day it will forever reoccur on this day—as will every other festival or annual date. The fact that the *mišmarot* documents 4Q319 and 4Q320 specify that the year begins on the fourth day of the week (cf. 4Q320 3 i 11–12) enables the calculation of the place of various festivals within the week. The following table summarizes the main features of the year:[32]

Days of the Week	**Months I, IV, VII, X**				
Sun		5	12	19	26
Mon		6	13	20	27
Tue		7	14	21	28
Wed	1	8	15	22	29
Thu	2	9	16	23	30
Fri	3	10	17	24	
Sabbath	4	11	18	25	
	Months II, V, VIII, XI				
Sun		3	10	17	24
Mon		4	11	18	25
Tue		5	12	19	26
Wed		6	13	20	27
Thu		7	14	21	28
Fri	1	8	15	22	29
Sabbath	2	9	16	23	30
	Months				

[32] This table was first presented by A. Jaubert, "Le calendrier des Jubilés et les jours liturgiques de la semaine," *VT* 7 (1957), 35. Although it was intended to represent the calendar of the *Book of Jubilees*, it now seems to better correspond to the calendars from Qumran, it being doubtful how much it remains applicable to *Jubilees*: see L. Ravid, "The Book of Jubilees and its Calendar – A Reexamination," *DSD* 10 (2003): 371–94; J. Ben-Dov, "Tradition and Innovation in the Calendar of Jubilees."

	III, VI, IX, XII				
Sun	1	8	15	22	29
Mon	2	9	16	23	30
Tue	3	10	17	24	31
Wed	4	11	18	25	
Thu	5	12	19	26	
Fri	6	13	20	27	
Sabbath	7	14	21	28	

TABLE 0.1: The 364DY—a tabular presentation

An analysis of TABLE 0.1 reveals the arithmetical potential contained in the yearly structure. The four quarters are fully symmetrical with respect to the structure of weeks and days. The first month of each quarter—i.e., months I, IV, VII, X—begins on day 4 of the week and ends on day 5; the second month of each quarter begins on day 6 and ends on the Sabbath; and the third month of each quarter begins on day 1 of the week and ends on day 3. Every quarter lasts for twelve full weeks plus two additional half weeks—altogether, 13 weeks or 91 days. The symmetry of the TABLE enables us to reconstruct the course of a full month on the testimony of one day.

The arithmetical potential of the 364DY is further revealed when cycles longer than one year are employed. A cycle of three schematic years is equated with 37 lunations in order to synchronize the solar and lunar orbits. This triennial cycle constitutes the basic unit in 4Q317 and some of the *mišmarot* texts. Two such cycles are in turn merged into the sexennial cycle of the service of the priestly courses. In the *otot* list of 4Q319, the sexennial cycles are further synchronized with the heptad-based cycles of *šemitah* and jubilee. The following numbers are thus woven into the matrix of multi-year Qumran calendars: 3 (triennial cycle), 4 (quarters), 6 (sexennial cycle), 7 (year of *šemitah*), 12 (heavenly gates in *1 Enoch*), 24 (priestly courses), and 49 (jubilee cycle).

When the positions of various priestly courses at the heads of years and other time-periods are noted, impressive arithmetical symmetries appear. This numerical harmony is best discerned in the tables which summarize the data of the *otot* list in 4Q319.[33] This text reads like a

[33] DJD XXI, 203, 207. For the aesthetic dimension in the structure of the *mišmarot* tables, see Elior, *The Three Temples*, 34–60.

fugue by Bach, with numerous time units neatly joined together to create an elaborate unified composition.

0.4.1 *Intercalation*

Given the above characteristics, the question arises whether any regular intercalation of the 364DY was practiced. Ironically, this is also the aspect of the discipline about which the least knowledge is currently available. The 364-day calendar tradition is committed to full correlation with the annual seasons, the latter being dependent on the sun's orbit. Without any intercalation, the 364DY would have lost any correlation it may have had with the sun's true motion within a relatively short period of time. This situation creates significant problems, since in the absence of intercalation the Qumran *yahad* members would have found themselves celebrating Pessah (the spring festival) in the winter cold or seeking new wheat for the harvest festivals in mid-February. How could the *yahad* members praise the divine order of the seasons (1QS X) and simultaneously observe their calendar permitting the seasons to pass by? If the 364DY was in use for at least 150 years—as is attested by the dates of the compositions which relate to it—it would have accumulated an enormous gap in relation to the real annual seasons.

At the same time, the entire corpus of literature both within and without Qumran contains no statement on intercalation, nor any device or scheme used for that purpose. On the contrary, the number of 364 days is praised in *1 Enoch* and in *Jubilees* as divinely ordained and immutable. The calendrical scrolls from Qumran anchor the key concepts of the 364DY in the very moment of the creation of the luminaries. Moreover, the numerical harmony of the year would necessarily be put at risk by any attempt at intercalation—whether by an additional day, week, or month. The sexennial *mišmarot* cycle was carefully designed in order to assign an equal period of Temple service to each of the priestly courses. Adding a week to the cycle would inevitably privilege one of the priestly families, creating severe conflicts between them—disagreements which rabbinic sources inform us were not easy to avoid. Yet the extant texts from Qumran display no concern whatsoever regarding any such disputes.

In the absence of tangible data, the most we can do is conjecture. Albani has usefully summarized the three primary schools of scholarship related to this question.[34] The first group considers the 364DY to be a purely theoretical entity which was never implemented and therefore required no intercalation. To the extent that it destroys the sacred schemes of time, adherents of the sectarian calendar would have considered any intercalation to be an abomination.[35]

The second school claims that the 364DY was practiced as a revolving year, never being intercalated, and thus virtually never corresponding to the true march of the seasons. This kind of year was based on *a priori* calculation rather than on observation. The time-gap between the 364DY and the orbit of the sun was explained as an outcome of mankind's sin, as described in *1 En* 80:2–8: "In the days of the sinners the years will grow shorter … The moon will change its order and will not appear at its (normal) time … many heads of the stars will stray from the command." The loyal members of the community were obligated to wait until the end of days before the correct maintenance of the cosmos would be restored to its pristine order.[36]

A third group of scholars assumes that some sort of intercalation scheme was applied to the 364DY by the periodical insertion of weeks. Due to the septenary structure of the year, only weeks could have been used.[37] More recently, Glessmer has suggested that the *otot* list in 4Q319 in fact constitutes an intricate manual of intercalation.[38] This hypothesis neither accounts for the necessary shift in the order of *mišmarot* due to the additional week or weeks nor is sufficiently anchored in the text of 4Q319, however.

It is inconceivable that the practitioners of the 364DY observed a regular pattern of intercalation. The power of the divine schemes was

[34] Albani, "Zur Rekonstruktion eines verdrängtes Konzepts," 103–10.

[35] See primarily, B.Z. Wacholder and S. Wacholder, "Patterns of Biblical Dates and Qumran's Calendar: The Fallacy of Jaubert's Hypothesis," *HUCA* 66 (1995), 36–37.

[36] See primarily, R.T. Beckwith, *Calendar and Chronology, Jewish and Christian: Biblical, Intertestamental and Patristic Studies* (AGAJU 33; Leiden: Brill, 1996), 133–40.

[37] For a survey of possible intercalation schemes, see Beckwith, *Calendar and Chronology*, 126–27.

[38] See the summary in Glessmer, "Calendars in the Qumran Scrolls," 263–68, and my reservations in DJD XXI, 210–11.

stronger than the potential damage caused by the ensuing time gaps—all the more so in a system primarily oriented towards calculation rather than observation. Adopting an intercalation device would necessarily admit the weakness of the divine scheme—an impossible acknowledgment. One must not rule out, however, the possibility that intercalations were enacted *ad hoc* when the time-gap accumulated to an unreasonable level. An analogy may be drawn from the situation in Rome at the time of the Julian reform (46–45 B.C.E.). Before the reform was enacted, nearly three months had to be inserted in the year in order to fix the time gap accumulated between the current Roman calendar and the sun's true motion.[39] Although this gap could not have gone unnoticed by previous rulers, none of them acted to correct it, evidently because calendar reckoning constitutes a conservative discipline which does not welcome frequent change. Whether in Judaea, Rome, or elsewhere, societies were reluctant to correct a calendrical system in any way once it had been installed. When a solution is required, it is more often than not implemented in sporadic acts rather than in an overall modification of the calendrical theory.

[39] E.J. Bickerman, *Chronology of the Ancient World* (London: Thames and Hudson, 1980[2]), 47. For *ad hoc* intercalations, see ibid, 30–33.

CHAPTER 1

UNIFYING ELEMENTS OF THE 364-DAY CALENDAR TRADITION

No argument concerning intercultural borrowing is justified until the student has first investigated his or her original discipline in detail.[1] Only when the discipline in question has been adequately defined and described "from within" is it legitimate to draw comparisons from other cognate disciplines. Anyone who fails to follow such procedures risks assigning anachronistic or incorrect cultural-dependant concepts to the discipline in question. For the task at hand, the constitutive concepts and Jewish context of the 364DCT must first be grasped. The present chapter will consider three such concepts of the calendar tradition, from its earliest embodiment in AB to the latest texts in the Qumran compositions. Such a synchronic survey of the data provides an all-encompassing view of the entire Jewish 364-day tradition. By definition, the unifying concepts should be apparent in the earliest stages of the tradition, in this case in parts of AB. Specifically, *1 En* 82:9–20 is recognized as a key text for understanding the conception of Time and its hierarchy within the parameters of the Jewish 364DCT. This passage, as well as other portions of AB, will be explored in detail below in order to clarify how these concepts extended into later calendrical texts in the Pseudepigraphal and Qumran literature. While the discussion below is broad in nature, textual problems arising from any of the specific passages treated will also be addressed.

The elements discussed below are:

1) the turn of the seasons

2) the tension between a 360-day and a 364-day year

3) the septenary principle of reckoning time

[1] See S. Talmon, "The Comparative Method in Biblical Interpretation: Principles and Problems," reprinted in his *Literary Studies in the Hebrew Bible – Form and Content* (Jerusalem/Leiden: Magnes/Brill, 1993), 11–49.

All three components are attested throughout the tradition from AB onwards, although the third element is present in the early stages of the tradition only in a preliminary state, gaining prominence in later stages.

1.1 *1 En* 82:9–20 AND THE HIERARCHIC DIVISION OF TIME

The unit *1 En* 82:9–20 presently stands at the conclusion of AB, although its original placement is still debated. In its distinct style and terminology it constitutes a good representation of the hierarchy of Time in AB.[2] Here, we quote vv. 9–14, where the general principles of time reckoning are conveyed.

> 9. This is the law[3] of the stars which set in their places, at their times, on their festivals and in their months.
>
> 10. These are the names of those who lead them, who keep watch so they enter at their times, who lead them in their places, in their orders, in their times, in their months, in their jurisdictions and in their positions.
>
> 11. Their four leaders who divide the four parts of the year enter first, and after them (come) the twelve leaders of the orders who divide the months, and the 360 heads of thousands who separate the days, and the four additional ones with them are the leaders who separate its four parts.
>
> 12. (As for) these heads of thousands between the leader and the led, one is added behind the position and their leaders make a division.[4]

[2] This translation follows G.W.E. Nickelsburg and J.C. VanderKam, *1 Enoch: A New Translation* (Minneapolis: Fortress, 2004), with occasional qualifications. While 4Q209 28 (DJD XXXVI, 165ff) contains Aramaic readings for parts of the present passage, it is not evident how the fragmentary Aramaic text matches the sequence of the Geez: see J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976), 295; M. Black in consultation with J.C. VanderKam, *The Book of Enoch or I Enoch: A New English Edition with Commentary and Textual Notes* (SVTP 7; Leiden: Brill, 1985), 418. A more detailed analysis of vv. 9–14 reveals further diachronic distinctions, which will be expanded on below 1.3.1.2.

[3] S. Uhlig, *Das äthiopische Henochbuch* (JSHRZ V, 6; Gütersloh: Gütersloher Verlaghaus Gerd Mohn, 1984), 669: "Ordnungen," following Geez *śerʿāt* (plural).

[4] This verse makes little sense. Neugebauer's very free rendition reads: "And concerning these heads over thousands: always one (of the four main leaders) is placed at the position between the leaders (of thousands) and their followers; but these (single) leaders separate (the seasons)": O. Neugebauer, "The 'Astronomical'

13. These are the names of the leaders who separate the four fixed parts of the year: Milkiel, Helemelek, Meleʾeyel, and Narel.

14. The names of those whom they lead (are): Adnareʾel, Iyasusel, and Elomeʾel. These three follow the leaders of the orders (of thousands); and (then again) one (of the four main leaders) follows the three leaders of the orders who (in turn) follow those leaders of the positions who separate the four parts of the year.

The beginning of the unit is marked by the title in v. 9, which follows the previous short paragraph 82:4b–8. The new pericope is distinguished by the minute detail in which it describes the division of the year and the various leaders and by its treatment of the hierarchy of stars and angels' names. Although Dillmann and Neugebauer consequently view vv. 9ff as a later insertion,[5] the detailed discussion of stars in other fragments, most notably 4Q211 ii–iii, reveals that vv. 9–20 are not foreign to the mode of thought of the original AB. This can also be seen from the correspondence between the vocabulary employed here and the description of the winds in 76:1ff.[6] Further, as shown below, vv. 9–20 continue the thought of such passages as 75:1–2 and 82:4b–6, although in greater detail. It would thus appear that, despite questions regarding its exact placement,[7] 82:9–20 was indeed

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Chapters of the Ethiopic Book of Enoch (72–82)," "Appendix A" in Black, *The Book of Enoch or I Enoch*.

[5] A. Dillmann, *Das Buch Henoch uebersetzt und erklärt* (Leipzig: F.C.W. Vogel, 1853), 248; Neugebauer, "Appendix A," 413. Uhlig, *Das äthiopische Henochbuch*, 669, makes a similar claim based on the history of angelology. Milik, *The Books of Enoch*, 295, tends to support this view, noting the distinct parchment of 4Q209 frg. 28, where the parallel Aramaic text appears (cf. M. Albani, *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch* [WMANT 68; Neukirchen-Vluyn: Neukirchener, 1994], 210); García Martínez and Tigchelaar rightly dispute this distinctiveness on material grounds (DJD XXXVI, 166).

[6] K. Koch, *Vor der Wende der Zeiten: Beiträge zur apokalyptischen Literatur: Gesammelte Aufsätze Band 3* (ed. U. Glessmer and M. Krause; Neukirchen-Vluyn: Neukirchener, 1996), 29.

[7] The question of the original placement of the passage is part of the wider aspect of verse sequence in the last chapters of AB (79–82). Based on the phrase "the Law of stars" in 82:9 and 79:1, VanderKam claims that AB originally ended in 82:8, while 82:9ff originally preceded chapter 79: *Enoch and the Growth of an Apocalyptic Tradition* (CBQMS 16; Washington, DC: Catholic Biblical Association of America, 1984), 79. Albani follows Kvanvig in stating that 82:9–20 originally stood between chapters 79 and 80: see Albani, *Astronomie und Schöpfungsglaube*, 40; H.S. Kvanvig, *Roots of Apocalyptic: The Mesopotamian Background of the Enoch Figure and of the Son of Man* (WMANT 61; Neukirchen-Vluyn: Neukirchener, 1988), 59. More recently, Olson has suggested an overall reshuffling of the original order of chapters

part of the original AB.

The unit may be divided as follows:

vv. 9–10 title

vv. 11–12 the law of the stars

vv. 13–14 the names of the four annual leaders + leaders of the months of each season

vv. 15–17 leader of the first season (spring)

vv. 18–20 leader of the second season (summer)[8]

The text of vv. 9–14 is very difficult, as it not only contains duplicates and contradictions but is also very confused. It is not entirely clear which "leader" comes first and who follows. Nor is the intention of each verse clear in relation to those preceding and following it. Likewise, some passages, such as the endless loop of v. 14, are simply unintelligible—hence the great variance in modern translations.

The import of the text unit appears to be that the inner division of the year corresponds to a hierarchy of angels or stars who stand at the head of each period of time and "lead" it. The year is divided into four seasons, twelve months, and 360 days. The four cardinal days, which stand between the seasons, are considered significant leaders in the hierarchy of Time. A large section of the argument is dedicated to elucidating the placement of these leaders—whether at the beginning of each season or at its end. The enigma with regard to the place of the cardinal days is undoubtedly linked to the more general question of whether these days should be included in the counting of the yearly calculus.

In the following sections, special attention will be paid to the concepts raised in 82:9–20 in order to highlight the unifying threads of the entire 364DCT.

79–82: D. Olson, *Enoch: A New Translation* (North Richland Hills, Texas: BIBAL, 2004), 273–76; see below 2.2.5.1.

[8] In the Geez version, the pericope is interrupted after two seasons. The Aramaic fragments (4Q211 i) preserve the winter season, and there can be no doubt that the original passage also contained the autumn: see Milik, *The Books of Enoch*, 296–97. Milik (p. 148) also suggests that the seasonal order of chapter 82 influenced the composition of *1 Enoch* 3, as well as a passage in the *Epistle of Clement*. Koch, *Vor der Wende der Zeiten*, 28, identifies two seasons rather than one in the above-mentioned Aramaic fragment.

1.2 Stars, Angels, and Priests: The Hierarchic Division of the Year

Vv. 11–14 introduce the leaders (*marāḥəyān*) of various time periods. The two highest levels—those representing seasons and months—are termed "leaders," while the lower level—representing the days—is called "heads of thousands" (*ʾarəʾəst* 1000).[9] Each leader has jurisdiction over a group of stars, whether large or small. This explains why the names of Helemelek and Milkiel in v. 13 contain royal epithets. The various responsibilities of the leaders are explicated in vv. 9–10, namely, leading the elements of Time through their appointed stations and tasks: places, times, festivals, months, orders, jurisdictions, and positions. All the latter terms are based on the Geez text, in the absence of full equivalents in Aramaic, with the exception of several extant leadership terms: דגליהון, מסרתהון, דבר, and שלטן.[10]

Vv. 9–10 state that the leaders have charge over the stars; can it also be claimed that the leaders are stars themselves? This seems to be the case in 82:15, which states that: "At the beginning of the year Melkeyal rises (*yəśarrəq*)." While the name Melkeyal could well refer to an angelic being, the verb *śaraqa* is regularly used to depict the rising of the luminaries. Furthermore, the closely parallel passage in 75:2 refers to the leaders as "luminaries (*bərhānāt*)"—i.e., stars. The function of stars as the heads of the seasons or of other time-periods is quite common in the ancient world, as evidenced, for example, in the Egyptian lists of stars and days.[11] This custom spread from Egypt into numerous other Ancient Near Eastern texts.[12] Whereas the Egyptian

[9] Cf. 4Q209 28 3: ראשין דׄ]י [לׄ]ן, "]chiefs of [thousands/signs"? (DJD XXXVI, 165). Dillmann, *Das Buch Henoch*, 247ff, expended considerable effort in an attempt to identify the various leaders by way of Hellenistic-Roman military titles: Taxiarchen, Toparchen, etc. Since this kind of typology is not apparent in the ancient texts, the appropriateness of this approach is disputable.

[10] For a discussion of leadership terminology in this passage, see Albani, *Astronomie und Schöpfungsglaube*, 209–13; B.A. Levine, "From the Aramaic Enoch Fragments: The Semantics of Cosmography," *JJS* 33 (1982): 311–26.

[11] See C. Leitz, *Tagewählerei. Das Buch ḥ3t nḥḥ pḥ.wy ḏt und verwandte Texte* (ÄA 55; Wiesbaden: Harrassowitz, 1994). Klaus Koch has suggested on the basis of these lists that the division in AB goes back to an Egyptian-Hellenistic setting (*Vor der Wende der Zeiten*, 29).

[12] See, for example, J. Bidez and F. Cumont, *Les mages hellénisé: Zoroastre, Ostanès et Hystaspe, d'après la tradition Grecque* (repr. Paris: Société d'édition ‹‹Les

texts employ far more elaborate classifications than those attested in the Jewish sources, the cognate Mesopotamian practice appears simpler and thus more closely corresponds to the material from AB. While in Mesopotamia, the assignment of stars over time periods occurs in such liturgies as the *lipšur* litanies, the hierarchy of fixed stars in Mul.Apin and related texts is more akin to the role these stars play in AB.[13] Sections A and B of Mul.Apin note the stars which rise in each of the three paths of heaven during the year, the first star rising in each of the paths at the New Year being described as a "leader" or "forerunner." A few examples follow:[14]

Mul.Apin I i 1

$^{mul.giš}$APIN ^{d}En-líl a-lik pa-ni MUL.MEŠ šu-ut ^{d}En-líl

The Plough star, Enlil, leader[15] of the stars of Enlil

Mul.Apin I i 40

^{mul}AŠ.IKU šu-bat ^{d}É-a a-lik IGI MUL.MEŠ šu-ut ^{d}A-nim

The Field star, seat of Ea, leader of the stars of Anu

Mul.Apin I ii 19

^{mul}KU$_{6}$ ^{d}É-a a-lik IGI MUL.MEŠ šu-ut ^{d}É-a

The Fish star, Ea, leader of the stars of Ea

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belles lettres››, 1973), 2:175–78, 271–73. Ethiopian astronomy employs a somewhat similar idea when designating each year in a four-year cycle by the name of one of the Evangelists: see O. Neugebauer, *Ethiopic Astronomy and Computus* (Österreichische Akedemie der Wissenschaften, philosophisch-historische Klasse, Sitzungsberichte 347; Vienna: ÖAW, 1979), 127.

[13] For the litanies, see E. Reiner, "'*Lipšur*' Litanies," *JNES* 15 (1956): 129–49; D.J. Wiseman, "A *lipšur* Litany from Nimrud," *Iraq* 31 (1969): 175–83. For the influence of Mul.Apin on AB, see Chapter 4 below.

[14] Quotations and translations follow H. Hunger and D. Pingree, *Mul.apin: An Astronomical Compendium in Cuneiform* (AfOBei 24; Horn: F. Berger & Söhne, 1989), 18, 29, 35.

[15] The phrase *ālik pāni*—lit. "forerunner"—also means "leader": see CAD A/I p. 345a.

The documents called “Astrolabes”—slightly earlier documents from the same tradition—give similar descriptions of the stars:

> $^{\text{mul}}$IKU ša i-na ZI IM.KUR.RA GUB-zu a-na IM.ÙLU$^{\text{lu}}$ GIB$^{!}$-ma MUL šu-ú MUL SAG.MU a-lik IGI MUL.MEŠ šu-ut $^{\text{d}}$É-a
>
> The Field star, who stands at the foundation of the east wind and spans to the south wind. That star is the New Year star, leader of the stars of Ea.[16]

In the Mesopotamian texts, the leaders of the seasons are equated with both stars and gods. Understandably, the Jewish text discussed here identifies the leaders-stars with angels rather than with gods. Stars are already identified as angels in such biblical verses as Job 38:7, and implied in *1 En* 86:1, 3 and 88:1. Such identification is explicit in other Second Temple literature, such as in the phrase מלׄאׄ]כי]מאורות כבׄודו “ang[els of] His glorious lights” in the *Song of the Maskil* (4Q511 2 i 8).[17] The identification of stars as angels is also common in other ancient sources.[18] In AB, the angels—primarily Uriel (72:1, 74:2, 75:3, 79:6) but also other angels, as in 82:13ff (cf. 80:1)—constitute the leaders of heaven.[19] The formula for introducing the angelic leaders in *1 En* 82:13 resembles the introduction of the angels in the Book of Watchers (*1 En* 6:8), which declares: “These are their chiefs of tens …”[20]

The preference of angels over stars when describing the leaders can be understood against the background of Israelite monotheism, which sought to avoid attributing divine status to celestial bodies.[21] Albani sees in this phenomenon part of what he calls the “anti-astrological

[16] J. Oelsner and W. Horowitz, “The 30-Star-Catalogue HS 1897 and the Late Parallel BM 55502,” *AfO* 44–45 (1997/98): 176–85.

[17] Baillet, DJD VII, 221. The translation follows *DSSR* 6, 173.

[18] See Mark 13:25; cf. also the corpus of Syriac incantations (c. sixth–seventh centuries C.E.) which employ the phrase “angels that rule over the twelve zodiacal si[gns (*mlwšʾ*)”: P. Gignoux, *Incantations magiques syriaque* (Louvain: Peeters, 1987), 53.

[19] See M.J. Davidson, *Angels at Qumran: A Comparative Study of 1 Enoch 1–36, 72–108 and Sectarian Writings from Qumran* (JSPSup 11; Sheffield: Academic Press, 1992), 91–95; D. Jackson, *Enochic Judaism: Three Defining Paradigm Exemplars* (LSTS 49; London: T&T Clark, 2004), 144–48.

[20] For this line, cf. 4Q201 1 iii 13; Milik, *The Books of Enoch*, 150; G.W.E. Nickelsburg, *1 Enoch 1* (Hermeneia; Minneapolis: Fortress, 2001), 175.

[21] I. Zatelli, “Astrology and the Worship of Stars in the Bible,” *ZAW* 103 (1991): 86–99; K. Koch, “Monotheismus und Angelologie,” in *Vor der Wende der Zeiten*, 219–34, esp. 27–30.

tendency" of AB.[22] The substitution of angels for stars establishes an ideological line which is typical of later Qumran astronomy: a preference for ideal schemes over actual observation. While contemporary science increasingly adopted empirical methods, the Qumran discipline of astronomy and calendars moved in the opposite direction, becoming ever more dependant on ideal schemes.[23] The acceptance of such schemes is far more easily accomplished in relation to angels than to stars, angels being much more difficult to observe!

Whether invoking stars or angels, *1 En* 82:9–20 highlights the importance AB attached to the hierarchic division of Time and the idea that every time period is "led" by a specific supernatural "forerunner." This ideology finds clear continuation in the calendrical texts from Qumran. A group of scrolls (4Q328, 4Q329, 4Q319 VII 2–7, 4Q324i) which belongs to a later stage in the development of the 364DCT, similarly depicts the hierarchy of Time. The complete list can be reconstructed on the basis of the first two scrolls; the evidence of 4Q319 and 4Q324i is less conclusive, although altogether reasonable.[24] The reconstruction is presented in DJD XXI according to the following order:[25]

1. Sequence of the names of the priestly courses without time notations (4Q324i, 4Q329 frg. 1).

2. Courses serving at the head of each year in the sexennial cycle (4Q328).

3. Courses serving at the head of each year-quarter of the above cycle (4Q328, 4Q329 frg. 2, 4Q319 VII 2–7).

4. Courses serving at the head of each month and week of the above cycle: head of month, followed by head of each week (4Q329 frg. 2).[26]

[22] Albani, *Astronomie und Schöpfungsglaube*, 248–49, 253–55, 260.

[23] On the development of this ideology, see R. Elior, *The Three Temples: On the Emergence of Jewish Mysticism* (trans. D. Louvish; Oxford: Littman Library of Jewish Civilization, 2004), 111–34.

[24] See DJD XXI, 212–13, 221–22.

[25] DJD XXI, 29ff, 146.

[26] The roster in 4Q319 frg. 9 lists *mišmarot* serving at the head of each month but not heads of weeks.

This sequence forms a master list of “temporal hierarchy” according to the priestly courses. The order it presents resembles that of *1 En* 82:11 and is based on the same hierarchic time division. The Qumran roster includes a multi-annual cycle, divided into units of years, quarters, months, and weeks. In contrast to *1 Enoch* 82, the shortest unit here is the week rather than the day. While the leaders over the shortest periods—the “heads over thousands”—are not identified by name in *1 Enoch* 82, the leaders of weeks are specified in the Qumran roster.

The last line of 4Q328 1 reads (summary formula italicized):

בחמישית ישב]אב בששית הפצץ אלה רשי השנים

> in the fifth (year) Yešeb]ab; in the sixth (year) Happiṣṣes; *these are the heads of the years*

While in rabbinic literature the term *roš haššanah* **ראש השנה** denotes the autumn New Year, this meaning does not appear in the Hebrew Bible.[27] The festival of “the head of the year” appears in Qumran only in the plural, as a poetic rather than concrete term.[28] The festival calendars from Qumran (e.g., 4Q320, 4Q321) do not record *roš haššanah* in relation to either the autumn or spring New Year, while the term is also absent from the *Temple Scroll*. The term “heads of years” in 4Q328 is therefore not a designation of the days of the New Year, as in *m. Roš Haš.* 1:1. Rather, the “heads” are the priestly courses serving at the head of each year. The end of a list of these courses is extant in 4Q328 1: Yešebab is the head of year 5, Happiṣṣes the head of year 6. Since the priests are in charge of the years,[29] it is legitimate to view this list as a continuation of the ideas presented in *1 Enoch* 82. The similarity in the hierarchy is well illustrated in the third paragraph of the reconstructed Qumran list, which resembles *1 En* 82:12: a leader for each quarter, under whom serve leaders of months within the quarter, who themselves serve over lower officials, either for the days (*1 Enoch*) or for the weeks (*mišmarot* calendars).

[27] Ezek 40:1 does not constitute a technical use of the term. See J. Milgrom, *Leviticus 23–27* (Anchor Bible; NY: Doubleday, 2001), 2164–65.

[28] See 1QS X 6 and cf. the reconstruction of 4Q286 1a ii 10 (B. Nitzan, DJD XI, 12); D. Falk, *Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls* (STDJ 27; Leiden: Brill, 1998), 190–91.

[29] Cf. 4Q320 3 i 12: “גמו]ל֯ ר֯[ו]ש כל השנים, Gamu]l he[a]d of all the years.”

The hierarchical division of time is discerned in yet another calendrical text: in 4Q319, each אות or "sign" is named after a priestly course—either Gamul or Šekaniah—which heads the period of three years until the next sign occurs. The similarity of the *mišmarot* calendars to AB is expressed in the strict temporal ranking, the division of the year into four and twelve divisions, and the assignment of a leader for each part. Differences pertain to the length of the time periods discussed: a) the sexennial cycle does not exist in AB; b) while the shortest time unit in *1 Enoch* 82 is the day, in Qumran it is the week; c) whereas the leaders in AB are either stars or angels, in 4Q328 they take the form of priestly courses.

The substitution of priests for stars in the task of heading time divisions is consistent with other concepts of the priesthood in Qumran literature, where earthly worship is frequently associated with heavenly worship.[30] Thus, for example, in the Song of the Maskil (4Q511 35 3–5):

והי֯ו֯ כוהנים ע֯ם צדקו צבאו ומשרתים מלאכי כבודו יהללוהו בה֯פלא נוראות

> And they shall be priests, His righteous people, His army, and ministers, His glorious angels. They shall praise Him for His awe-inspiring wonders.[31]

Similarly, the *Rule of Benedictions* (1QSb IV 24–27) invokes a blessing over the priests:

ואתה כמלאך פנים במעון קודש ל֯כ֯בוד אלהי צ֯ב֯א֯[ות   ת]ה֯יה סביב משרת בהיכל
מלכות ומפיל גורל עם מלאכי פנים. ... וישימכה קוד[ש] ב֯עמו ו֯למ֯אור[...]   לתבל
בדעת ולהאי֯ר פני רבים]

> And (may) you (be) like an Angel of the Presence in the Abode of Holiness, for the glory of the God of [H]ost[s … May] you be round about serving in the temple of the kingdom and may you cast a lot with the Angels of the Presence … May he make you hol[y] among his

[30] See Elior, "Priests and Angels," in *The Three Temples*, 165–200. Second Temple texts frequently associate the priest with the sun or one of the stars in similar fashion: cf. Dan 12:3; *Sir* 45:17, 50:6–7; *T. Levi* 4:3, 18:3–4; cf. also the brief note by D. Olson in *Pseudepigraphic and Non-Masoretic Psalms and Prayers* (ed. J. Charlesworth; Tübingen-Louisville: Mohr Siebeck-Westminster, 1997), 108; M. Kister, "Levi = Light," *Tarbiz* 45 (1976): 327–30 (Hebrew); J.M. Baumgarten, "The Heavenly Tribunal and the Personification of Ṣedeq in Jewish Apocalyptic," *ANRW* X.1 (1979): 219–39, esp. 229f. For priests as angels, see C. Fletcher-Louis, *All the Glory of Adam: Liturgical Anthropology in the Dead Sea Scrolls* (STDJ 62; Leiden: Brill, 2002), 56–87, 150–221, and earlier bibliography cited there.

[31] DJD VII, 237. Translation follows *DSSR* 6, 185.

> people, and to give light[…] to the world with knowledge, and to illumine the face of the Many[32]

To sum up, various sources within the 364DCT texts stress the hierarchic division of Time and the assignment of a leader for each period, whether this figure be a star, an angel, or a priest.

1.3 THE TURN OF THE SEASONS AND THE CARDINAL DAYS OF THE YEAR

One of the constitutive elements of the 364DCT is its fourfold division of the year. The origins of this tradition go back to Mesopotamia, where the water-clock model tracked the place of the sun in the paths of heaven in each of the four seasons (see below 4.1.1). Accordingly, the scriptural verse in Gen 8:22—"So long as the earth endures, seedtime and harvest, cold and heat, summer and winter, day and night shall not cease"—was often conceived to reflect the fourfold division in *1 Enoch*, *Serek*, and *Hodayot*.[33] *1 En* 82:9–20 expands upon this scriptural verse by further noting the four seasons and the agricultural and climatic phenomena characteristic of each. In this sense, the 364DCT constitutes a continuation not only of scientific-technical but also of agricultural-popular traditions. *1 Enoch* 82 resembles not only the "scientific" parts of Mul.Apin-type texts but also the menologies preserved in those texts.

As the following survey indicates, several motifs related to the annual seasons which originate in AB continue to appear throughout the entire 364DCT and into the *yaḥad* literature. These unifying lines—both scientific and popular-agricultural in nature—confirm the consistency of the 364DCT.

[32] Hebrew text and translation follow J. Charlesworth and L. Stuckenbruck in J. Charlesworth (ed.), *Rule of the Community and Related Documents* (Tübingen-Louisville: Mohr Siebeck-Westminster, 1994), 126–28.

[33] S. Talmon, "The Gezer Calendar and the Seasonal Cycle of Ancient Canaan," *JAOS* 83 (1963): 177–87; idem, "The 'Manual of Benedictions' of the Sect of the Judaean Desert," *RQ* 2.4 (1960): 475–500.

The fourfold division of the year is dictated to a large degree by the technical model for the sun's orbit in *1 Enoch* 72, which in many senses forms the very foundation of AB. This chapter contains a spatio-temporal model for the sun's motion along the twelve schematic months which comprise the full year. We shall briefly outline a sketch of this model.[34]

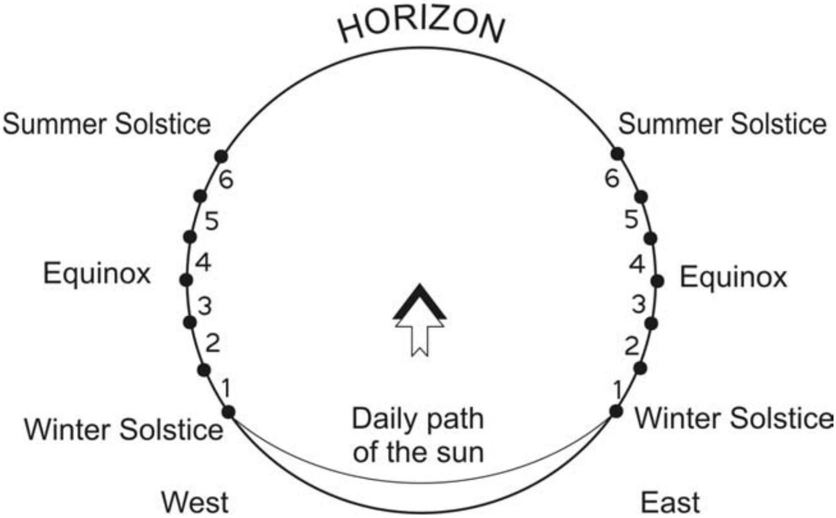

*FIGURE 1.1: Motion of the sun in the gates of heaven (*1 Enoch *72)*

The horizon is divided into twelve gates: six gates on the eastern horizon, from which the sun rises, and six on the west, where the sun sets. The gates are numbered 1–6 from south to north on the horizon. The sun rises in one specific gate each month and sets in the corresponding gate in the west throughout that month. At the end of the month, it moves through to the next gate. For the sake of convenience, we shall henceforth relate only to the eastern gates. In month I, the sun passes through the middle gate 4; it then moves northwards to rise in gate 5 during the second month, until it reaches the northernmost gate 6 in month III. The sun continues to rise in gate

[34] This FIGURE is adapted from Albani, *Astronomie und Schöpfungsglaube*, 47. For a fuller explication of this model in the light of ancient science, see below 4.3.

6 through the next month (IV), only moving southwards in the next month (V). Between months VI and VII, the sun again passes gate 4. It reaches the southernmost gate 1 in month IX, where it remains for an additional month (X) before returning northwards.

An additional component of *1 Enoch* 72 is the practice of measuring of the length of daylight and night time using units called "parts"—altogether eighteen parts in a nychthemeron (= 24 hours). At the equinoxes, day and night measure nine parts each, while the M:m ratio at the solstices reaches 12:6. Notes on the length of daylight accompany the description of the heavenly gates, laying further emphasis on the fourfold division of the year and its cardinal days, which serve as pivotal points for the alteration of the day:night ratio.

Although the association of the two factors—the sun's position and the length of daylight—is common in Mul.Apin and related sources,[35] it merits further attention in the Jewish context. Gen 8:22, which played a key role in the fashioning of the 364DCT, mentions not only the annual seasons—"seedtime and harvest, cold and heat, summer and winter"—but also "day and night." The fact that Scripture associates the alteration of the seasons with that of day and night was certainly noticed by the Enochic author, as were other biblical sources which helped to fashion his worldview.[36]

The solar model marks the four cardinal days as the key points of the sun's movement through the gates as follows:

1. The year begins at the spring equinox in gate 4. Day:night ratio 9:9

2. The sun reaches the summer solstice at the northernmost gate (6). Day:night ratio 12:6

3. At the autumn equinox the sun again reaches gate 4 (cf. 75:2). Day:night ratio 9:9

4. The sun reaches the winter solstice at the southernmost gate (1). Day:night ratio 6:12

[35] See the discussion of the water-clock model in Chapter 4 below.

[36] Gen 8:22 should thus be added to the sources noted by J.C. VanderKam, "Scripture in the Astronomical Book of Enoch," in *Things Revealed: Studies in Early Jewish and Christian Literature in Honor of Michael E. Stone* (JSJSup 89; ed. E. Chazon et al.; Leiden: Brill, 2004), 89–103.

Both the sun's position and the length of daylight can be expressed in a linear zigzag pattern typical of Babylonian-type science (FIG. 1.2).

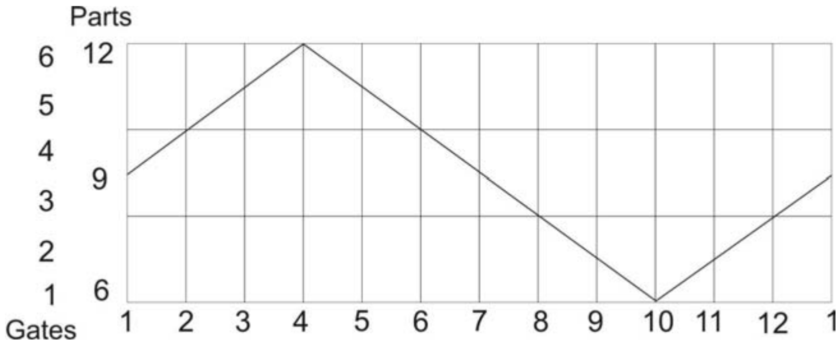

FIGURE 1.2: Linear zigzag function of: 1) length of daylight; and 2) the place of the sun in the gates of heaven

The system of heavenly gates was created in order to trace the changes in the sun's azimuth at sunrise and sunset throughout the year. This apparently primitive system yields reasonably accurate measurements.[37] As Neugebauer notes:

> … the rising (and setting) amplitude of the sun can be assumed to be about 60º. The six equal arcs, of 10º each, from 30º south of East to 30º north of it (and similarly in the West) can be shown to correspond equally well to the six "gates," numbered from south to north. In other words the rising from a "gate" refers to a section of the horizon where the sun or the moon appears.[38]

1.3.1.1 *The 360-day Year*

The solar model of AB assumes a uniform motion of the sun—thirty days in each gate—as stated in 74:17:

> …they [the phases of the moon; JBD][39] rise from the gate from which it (the sun) rises and sets for thirty days

[37] See also below 4.3.3.

[38] Neugebauer, *Ethiopic Astronomy and Computus*, 156; cf. also p. 54; Albani, *Astronomie und Schöpfungsglaube*, 76; U. Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," *Henoch* 18 (1996), 274.

[39] Thus Uhlig, *Das äthiopische Henochbuch*, 650. The pronoun "they" may also refer to the sun and moon: see M.A. Knibb, *The Ethiopic Book of Enoch: A New Edition in the Light of the Aramaic Dead Sea Fragments* (Oxford: Clarendon, 1978), 2:174.

According to this statement, the length of the year is 12 x 30 = 360 days, with no mention of the cardinal days. This represents the ideal year length, which originated in Mesopotamia at a very early period.[40] The detailed account of chapter 72, however, runs counter to 74:17 in assigning an additional day (day 31) for the sun's passage through the gates at the cardinal points. Thus, for example, 72:13–15 describes the sun's passage through gate 6 at the summer solstice, between months III and IV:

> … It emerges and sets through the sixth gate for thirty-one[41] days because of its sign. During that day the daytime grows longer than the night …

Similarly 72:19–20 comments regarding the autumn equinox:

> … it rises through the fourth gate because of its sign—in the fourth gate of the east—thirty one mornings … on that day the day is equal to the night.

Similar reckonings also appear in vv. 25, 31. The days on which the sun reaches its cardinal points are therefore considered within the count of the year, constituting the thirty-first day at the end of every third month. Each quarter thus numbers 91 days, the entire year being composed of 364 days. Although this is the prevalent number in the Qumran calendrical discipline, according to mechanical physics the model of chapter 72 does not require these additional days; in fact, they interrupt the uniform motion of the sun.[42] For example, when the sun is heading south from gate 6 (month IV) to gate 1 (month IX), it rises for precisely thirty days through each gate, except for gate 4 (month VI) where it unnecessarily remains for an additional day (31). Thus although the four additional days represent a constitutive component within the 364DY texts, the reason for their inclusion is not a purely scientific one. On the contrary, this model is better suited

[40] See J. Ben-Dov and W. Horowitz, "The 364-day Year in Mesopotamia and Qumran," *Meghillot* 1 (2003), 5–7; J.P. Britton, "Treatments of Annual Phenomena in Cuneiform Sources," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 23.

[41] This reading follows group II of Ethiopic mss, whereas the usually preferable group I reads "thirty days": cf. Uhlig, *Das äthiopische Henochbuch*, 641. While the reading "thirty days" instead of "thirty-one days" as in 72:13 may reflect the pre-redactional text, it more likely constitutes a late corruption or correction, designed to correspond to an adjacent month

[42] Cf. Neugebauer, "Appendix A," 402.

to the ideal 360-day year. It should therefore be assumed that the additional days were included on ideological grounds, in order to give special importance to the fourfold division of the year.

The ambiguous role of the four cardinal days led earlier scholars to the conviction that AB was originally based on a 360-day year, the number 364 representing later redaction.[43] The analysis of chapter 72 presented here supports this opinion. Most significantly, the "364-day" redaction layer buttressed the new system with several statements which both condemned the earlier 360-day count and underscored the importance of the cardinal days. The best example of this tendency is found in *1 En* 82:4b:[44]

> (a) … in numbering all the days the sun travels in the sky through the gates, entering and emerging for thirty days
>
> (b) with the heads of thousands of the order of the stars, with the four additional ones that divide between the four parts of the year that lead them and enter with the four days

The redaction is clearly discernible here. While line (a) is reminiscent of 74:17, quoted above as signifying a 360-day year with not more than thirty days in each month, line (b) presents the view that the year

[43] The two layers within AB have been variously identified by different scholars. E. Rau recognised a solar orientation within the earlier source as against a stellar orientation in the later redaction: "Kosmologie, Eschatologie und die Lehrautorität Henochs: Traditions- und formgeschichtliche Untersuchungen zum äthiopischen Henochbuch und zu verwandten Schriften" (Dissertation, Hamburg 1974); quoted and rejected by Albani, *Astronomie und Schöpfungsglaube*, 58. Rau's view is based on the description of the four additional days as stars in 75:2. Other scholars have explained the two layers as propagating a 360-day and a 364-day year respectively: see P. Sacchi, "The Two Calendars of the Book of Astronomy," in *Jewish Apocalyptic and Its History* (JSPSup 20; trans. W.J. Short; Sheffield: Academic Press, 1990), 128–31; G. Boccaccini, "The Solar Calendars of Daniel and Enoch," in *The Book of Daniel: Composition and Reception* (VTSup 83; ed. J.J. Collins and P.W. Flint; Leiden: Brill, 2001), 2:313–18; cf. Albani, *Astronomie und Schöpfungsglaube*, 50, 57. Sacchi based his argument for the existence of a later redaction on the numerical disharmony in 74:10–16, for which see below 3.3. The difference between Sacchi and Boccaccini on the one hand and Albani on the other lies in the fact that the former authors construe the year in the original source as consisting of 360 + 4 days, with the additional days not included in the count of the year. Albani, on the other hand, believes the original number to have been 360. Albani's view should be preferred in light of the Mesopotamian background of the issue, which Sacchi fails to address: cf. VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*, 97–98.

[44] Verse 4a belongs with the admonition in 81:1ff and should not be linked to 4b: see Nickelsburg, *1 Enoch 1*, 334 (*contra* Albani, *Astronomie und Schöpfungsglaube*, 33, who places the division between vv. 3 and 4).

is incomplete without the four additional days. This verse thus contains two opposing views with regard to the length of the year, with line (b) representing the redactional layer. Another pericope by the redactor (82:5–6) concurs with line (b):

> People err regarding them and do not calculate them in the numbering of the entire world … for they belong in the reckoning of the year and are indeed recorded forever …

Such a distinction between source and redaction can also be seen in the parallel passage, 75:1–2, which constitutes a summary of chapters 72–74.[45] Once again, while v. 1 excludes the "additional" days from the count of the year, this view is clearly countered in v. 2:[46]

> 1. The leaders of the heads of the thousands … (have to do) with those four (days) that are added; they are not separated from their position[47] … and they serve on the four days that are not reckoned in the calculation of the year.
>
> 2. People err regarding them because those lights truly serve … and the year is completed precisely in the 364 positions of the world.[48]

75:1 serves as a good indicator of the status of the four "additional" days in the initial reckoning of AB. The original author did not ignore them but acknowledged their key position at the turn of the seasons, counting them within the 30 days of each month and within the 90 days of the season. In the redactional layer they were then marked separately and reassigned as days 91, 182, 273, and 364 of the year. Since the redaction is already apparent in the earliest textual witnesses for AB, the first redactor appears to have been active at a very early stage of AB's composition.[49]

[45] Dillmann, *Das Buch Henoch*, 232, notes the similarity between 75:1–2 and 82:4–8, both of these passages concluding previous units dealing with the motion of the luminaries: see in detail below 2.3; cf. Sacchi, "The Two Calendars of the Book of Astronomy," 131–32. Sacchi perceives the whole of chapter 75 as secondary, however.

[46] For the contradiction between vv. 1 and 2, see Neugebauer, "Appendix A," 402; Boccaccini, "The Solar Calendars of Daniel and Enoch," 315.

[47] Cf. Uhlig, *Das äthiopische Henochbuch*, 650.

[48] This reading follows ms Tana 9, preferred here by Uhlig and Knibb (*contra* VanderKam and Nickelsburg). For this line, see further below 2.3.

[49] See U. Glessmer, "Explizite Aussagen über kalendarische Konflikte im Jubiläenbuch," in *Studies in the Book of Jubilees* (TSAJ 65; ed. M. Albani et al.; Tübingen: Mohr Siebeck, 1996), 144 n. 59.

1.3.1.2 *The Cardinal Days: The Beginning or End of Every Season?*

Returning to 82:9–14, a close analysis reveals how the tension between the counts of 360 and 364 days created a conceptual difficulty with respect to the accurate placement of the cardinal days. When attempting to present an accurate order of the various leaders in v. 11, the author accordingly encountered a problem:

> (a) Their four leaders who divide (*yəlelləyu*) the four parts of the year enter first
>
> (b) And after them (come) the twelve leaders of the orders who divide (*yəlelləyəwomu*) the months[50]
>
> (c) And the 360 heads of thousands who separate (*yəfalləṭəwomu*) the days
>
> (d) And the four additional ones with them are the leaders who separate (*yəfalləṭu*) its four parts

Lines (a)–(c) present the order within each *tequfah*: (a) the leader of the quarter, being one of the cardinal days; followed (b) by the leaders of the months, three such leaders existing in each quarter; and finally (c) the leaders of days, 90 leaders in each quarter. The result is the following outline:[51]

> Leader of *tequfah*
>
> Leader of month 1 > leaders of days 1–30
>
> Leader of month 2 > leaders of days 31–60
>
> Leader of month 3 > leaders of days 61–90

[50] Readings at the end of this line are extremely variegated. Most mss add the words "and the years into 364 (days)" (*walaʿāmatāt* 364). This variant sometimes complements the number 360 at the beginning of the next line and at other times replaces it. The longer reading is preferred by Dillmann and Knibb, while Neugebauer, Isaac, and Nickelsburg-VanderKam prefer to end the line with "the months," as quoted above. Although the latter version seems preferable (thus Uhlig, *Das äthiopische Henochbuch*, 669), the fact that tension between 360 and 364 days remained largely unsettled well accounts for the struggle by generations of scribes to discover various resolutions. Double readings appear to be an inherent trait of the present verse.

[51] Following Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," 279.

Line (d) does not seem to fit into this scheme, appearing as it does to render line (a) superfluous. This line again introduces four leaders "who separate its four parts." What is the location of these additional leaders? To judge from the order of v. 11 they should stand at the end of each *tequfah*. This is Boccaccini's opinion, who further claims that these leaders are also considered to be both "ordinary leaders of days" (that is, the concluding day of each quarter) and special leaders in their own right.[52] This partitioning inevitably leads to a collision between the leaders standing at the head of each season and those standing at its end.[53] We should therefore conclude that 82:11 reflects an ambiguity regarding whether the leaders of the quarters should be placed at the beginning or end of each season. While this ambiguity may derive from careless redaction or faulty transmission, it may also reflect an original confusion on the part of the original author or amongst the copying scribes.

One wonders whether parts of the obscure vv. 12 and 14 may not represent later attempts to resolve the ambiguity of who comes first: leader or led.[54] V. 12, for example, struggles with the identity of the two types of leaders mentioned earlier. It reaches the conclusion that the last day of each season is represented both by a leader of the entire season and by an ordinary leader of the day: "(as for) these heads of thousands between the leader and the led, one is added behind the position and their leaders make a division."[55] It is not entirely clear whether v. 14 concurs with this opinion. Neither v. 12 nor v. 14 fully resolves the status of the four additional days.

A more resolute idea seems to appear in 75:1–2. 75:2 places "those lights"—i.e., the cardinal days—in set positions at gates 1, 3, 4, and 6. The sun rises through those gates when it reaches the cardinal points:

[52] Boccaccini, "The Solar Calendars of Daniel and Enoch," 316–17.

[53] This was also noted by Neugebauer, "Appendix A," 414; cf. E. Kutsch, "Die Solstitien im Kalender des Jubiläenbuches und in äth. *Henoch* 72," *VT* 12 (1962): 205–7.

[54] Note the comment on v. 12 by Charles, *The Book of Enoch or 1 Enoch*, 177: "I don't understand this verse." Furthermore, attempts to reconstruct the relationship between the Geez version and the Aramaic fragment 4Q209 28 raise the possibility that v. 12 was not represented in the Aramaic at all and that the text ran straight from v. 11 to v. 13.

[55] Interpreted according to Dillmann, *Das Buch Henoch*, 249. Neugebauer also recognizes the ambiguity in v. 14 with respect to the priority of the various leaders on the borders between seasons: "Appendix A," 414.

the summer solstice (gate 6), winter solstice (gate 1), autumn equinox (gate 3; cf. 72:31–32), and spring equinox (gate 4).[56] As the TABLE below indicates, these numbers are valid for the beginnings of the seasons rather for their endings:

Gate	Month
3	XII
4	I
5	II
6	III
6	IV
5	V
4	VI
3	VII
2	VIII
1	IX
1	X
2	XI
3	XII
4	I

TABLE 1.2: The place of the sun at the beginning of each schematic month (75:2)

The two possible solutions raised in AB—cardinal days at the head or end of each season—resurface in later stages of the 364DCT. Thus AB demonstrably contains the guidelines for the calendrical discourse in later sources.[57]

1.3.2 *The* Aramaic Levi Document *(ALD) and the* Book of Jubilees

The *Aramaic Levi Document* mentions the cardinal days of the year, thereby reflecting its connection with the 364DCT. In the Genizah version, this text recounts the dates of birth of Levi's children as follows: 1/I (Qehat), 1/VII (Yocheved), month X (Gershom), and

[56] The different rising points at the equinoxes are explained in Neugebauer, "Appendix A," 402; cf. his drawing on p. 394 there.

[57] Cf. the baraita in *b. Sanh*. 13a: "The *tequfah* day concludes [the previous season]; this is R. Judah's view. R. Jose maintains that it commences [the new]" (Soncino translation).

month III (Merari).[58] While the births on months I, VII, and X correspond to the times of the cardinal points in a schematic year of 364 days, month III is problematic in this regard. The text is preserved in a Qumran copy of ALD (4Q214a 2–3 i 3), although unfortunately the exact word is not entirely extant. Stone and Eshel read here שב/רב]יעא, "fou]rth"/"seve]nth" instead of "third."[59] This reading seems preferable, since it retains the framework of four cardinal days fixed at a specific temporal interval from one another. It also underscores the status of the four days in such a relatively early source as ALD.

The importance of the cardinal days is also apparent in the *Book of Jubilees*, especially in its treatment of the flood narrative. Chapter 6 of *Jubilees* contains the book's most extensive treatment of the calendar. In retelling the flood narrative, the account in *Jubilees* places special emphasis on the centrality of the annual seasons in the division of the flood's duration. This elaboration is based on Gen 8:22, a verse which marks the divisions between the seasons as a fundamental element of the world's order.

The author of *Jubilees* reworks the biblical flood narrative, aligning it with the 364DCT and highlighting the cardinal days. The sequence of dates in *Jub* 5:29–30 thus reads as follows:

> During the fourth month the sources of the great deep were closed …
>
> On the first of the seventh month all the sources of the earth's deep places were opened …

[58] Chapter 11 according to the numbering of J.C. Greenfield, M.E. Stone, and E. Eshel, *The Aramaic Levi Document: Edition, Translation, Commentary* (SVTP 19; Leiden: Brill, 2004). Concrete dates within months X and III were not preserved. For a summary of this issue, see ibid, 94–97, 188–90, where the authors also note that the date 1/I is marked as Levi's birth date in *Jub* 28:14 and that according to *Jub* 38:24 Joseph was born on 1/IV. All these dates were presumably considered days of good omen for birth. On ALD as a possible source for the *Book of Jubilees*, see C. Werman, "Levi and Levites in the Second Temple Period," *DSD* 4 (1997): 211–25.

[59] Stone and Greenfield, DJD XXII, 56–57; Greenfield, Stone, and Eshel, *The Aramaic Levi Document*, 190. A different reading is suggested by H. Drawnel, *An Aramaic Wisdom Text from Qumran: A New Interpretation of the Levi Document* (JSJSup 86; Leiden: Brill, 2004), 191: "בירחה ת]שׁ̊עא in month n]ine." An inspection of the photo PAM 43.260 yields an ambiguous result. The right-most sign in line 3 is too thin to be the left downstroke of *šin* and in addition does not show a thickening at its bottom, where the other arm(s) of *šin* should meet. On the other hand, it does not display the pronounced triangle which usually accompanies the top of *yod* in that scroll. Overall, the reading by Stone and Eshel seems preferable.

> On the first of the tenth month the summits of the mountains became visible[60]
>
> On the first of the first month the earth became visible

And again in *Jub* 6:25–27:

> On the first of the first month he was told to make the ark, and on it the earth became dry … on the first of the fourth month the openings of the depth of the abyss below were closed. On the first of the seventh month all the openings of the earth's depths were opened, and the water began to go down into them. On the first of the tenth month the summits of the mountains became visible.[61]

While Gen 8:5, 13 marks the dates 1/X and 1/I, the other two days of *tequfah* are not mentioned in the biblical text. Furthermore, as Werman has demonstrated, the dates in *Jubilees* contradict the biblical account at several points.[62] It is thus clear that the author of *Jubilees* took special pains to anchor the four seasonal markers in his account of the flood.

As per its usual style, *Jubilees* utilizes the narrative to support a newly-introduced regulation. In this case, the flood narrative is appealed to in order to give credence to a statute celebrating the divisions between the seasons (*Jub* 6:23–29):

> On the first of the first month, the first of the fourth month, the first of the seventh month, and the first of the tenth month are memorial days and days of the seasons (*ʿəlatāt gize*). They are written down and ordained at the four divisions of the year … Noah ordained them as festivals for himself … and they enter them on the heavenly tablets. Each one of them (consists of) 13 weeks.

The author wished to emphasise the role of the cardinal days not only in connection with past occurrences of the flood but also with regard to later generations. With respect to the ambiguity reflected in *1 En* 82:9–14, this section of *Jubilees* clearly takes the position that the cardinal days stand at the head of each season (6:23). Further support for this view comes from *Jub* 7:1–2, where the dates 1/VII and 1/I are

60 For this passage, cf. M. Kister, "Studies in 4QMiqṣat Maʿasei HaTorah and Related Texts," *Tarbiz* 68 (1999), 361 n. 209 (Hebrew).

61 For the complicated textual history and problems in the chronological data of these verses, see the notes by J.C. VanderKam, *The Book of Jubilees* (CSCO 510; Scriptores Aethiopici 87; Leuven: Peeters, 1989), 2:41.

62 C. Werman, "The Flood Story in the Book of Jubilees," *Tarbiz* 64 (1995): 183–202 (Hebrew).

marked as significant for the harvest offering, probably due to the special importance of these dates in the structure of the year.[63]

The issue of the place of the cardinal days in *Jubilees* is more problematic. In 29:15–16, the author reports how Jacob sent fruits from his harvest as a tribute to Rebecca:

> To his mother Rebecca, too, (he sent goods) four times per year—between the seasons of the months, between plowing and harvest, between autumn and the rain(y season), and between winter and spring.

As usual in *Jubilees*, the story reflects the recurrent importance of the days which mark the turn of the seasons.[64] The phrase "between the seasons of the months (*māʾəkala gizeyātihomu laʾawrāḫ*)" demands specific attention. It implies that the turn of the seasons is not simply the first day of each season, as stated in chapter 6, but an intermediate period of time, standing between the seasons rather than at their beginning or end. The *Book of Jubilees* thus preserves some of the ambiguity regarding the turn of the seasons reflected in AB. More precisely, although the author marked the first day of each season as the crucial festive day for cultic purposes, he maintained the intermediate definition of that period with regard to the division of the agricultural year.

Finally, yet another factor should be noted with regard to *Jub* 29:16 and its relation to AB. Since the turn of the seasons occurs *between* the schematic months rather than at a date in their midst, it is clear that the author follows the same system as occurs in AB and subsequently at Qumran. In this system, the division of months corresponds to the boundaries of the seasons. The fact that the author does not employ lunar dates to locate the sun's turning points places him on a continuum with AB. As a point of comparison, *2 En* 48:2 fixes the cardinal days on the seventeenth of the months Tamuz and Tebet,

[63] See J.M. Baumgarten, "The Calendars of the Book of Jubilees and the Temple Scroll," *VT* 37 (1987), 74. The interpretation of *Jubilees* 7, however, contains more than meets the eye, since the story of Noah's sacrifice is closely paralleled in the Genesis Apocryphon: see M. Kister, "Some Aspects of Qumranic Halakhah," in *The Madrid Qumran Congress: Proceedings of the International Congress on the Dead Sea Scrolls, Madrid 18–21 March 1991* (STDJ XI; ed. J. Trebolle Barrera and L. Vegas Montaner; Leiden: Brill, 1992), 2:571–88.

[64] Cf. Boccaccini, "The Solar Calendars of Daniel and Enoch," 319. Note also the similarity of this verse to Gen 8:22.

indicating that they cannot stand "between the months."[65]

The significance of the four days at the turn of the seasons in *Jubilees*—possibly due also to the influence of ALD—locates the book along a continuous line which stretches from Mesopotamia to the Qumran calendrical scrolls. Any attempt to trace *Jubilees* to a different calendrical tradition must account for this fact.[66]

1.3.3 *The* Serek *Hymn 1QS X and Related Texts*

The turn of the seasons forms a central element in the "Hymn of the Seasons" in 1QS IX 26–X 8.[67] This hymn consists of two poetic strophes, both of which laud the divinely-ordained times for prayer. While the first strophe deals with short time periods, the second celebrates longer time periods: months, seasons, years, sabbatical years, and jubilee year cycles. The majority of the lines of this hymn are designed to convey a *merismus*—i.e., they span the complete period of time discussed in that line, as in X 1:

> At the beginning (ברשית) of the dominion of light
>
> At its turning point (עם תקופתו)
>
> And when it completes its course (בהאספו)

This artistic structure, which recurs in slight variants throughout the text, buttresses the hymn's main message. It points at the apparently

[65] See C. Böttrich, *Das slavische Henochbuch* (JSHRZ V, 7; Gütersloh: Gütersloher Verlaghaus, 1995), 966–67. It is not impossible that the choice of day 17 is connected to the dates 17/II and 17/VII in the flood narrative, both in the Bible and in 4Q252. Since the flood narrative serves as a prooftext with regard to the annual seasons, it may have been taken as a guide also in *2 Enoch*. For the cardinal days on the seventeenth, see also Neugebauer, *Ethiopic Astronomy and Computus*, 208.

[66] L. Ravid, "The Book of Jubilees and Its Calendar – a Reexamination," *DSD* 10 (2003): 371–94, has suggested an Egyptian origin for the calendar of *Jubilees*. While this is not the place to consider her thesis in full, we may note that the Egyptian civil year was divided into three seasons rather than four, a crucial discrepancy from the calendar of *Jubilees*. Furthermore, the epagomenal days in Egypt were not distributed between the ends of the seasons but rather placed as a cluster at the end of the year.

[67] The copy 4QS[e] (4Q259) does not contain this hymn, producing instead a calendrical list of signs (*otot*), erroneously designated as 4Q319. A parallel thanksgiving psalm (1QH[a] XX; Sukenik XII) adds very little to the version in 1QS: see Y. Licht, *The Rule Scroll* (Jerusalem: Bialik Institute, 1965), 204 (Hebrew); Talmon, "The 'Manual of Benedictions' of the Sect of the Judaean Desert," 477ff; B. Nitzan, *Qumran Prayer and Religious Poetry* (STDJ; Leiden: Brill, 1995), 52–59.

opposed notions of the distinctiveness of each time period on the one hand and the endless flow of Time on the other. The constant repetition of this alleged contrast ultimately leads the reader to the conviction that it is not a contrast at all but rather a dialectic—an innate tension in the structure of Time brought forth by the Creator. This dialectic serves as the real object of praise in the hymn. The hymn thus exemplifies Eliade's thesis regarding the dialectic of linear and circular time.[68] While it is difficult to understand the specific time terminology employed in each line owing to the awkwardness of the poetic language, the point is nevertheless clear.

The hymn is significant for its conception of the annual seasons and their regular alternation, as part of the overall message described above. The two strophes share functionally similar lines on the alternation of times:

lines 3–4

במבוא מועדים לימי חודש יחד תקופתם עם מסרותם זה לזה

When fixed phases in the days of the month begin / together with their turning points / and their transmitting one to the other.

lines 6–7

בראשי שנים ובתקופת מועדיהם בהשלם חוק תכונם יום משפטו זה לזה

At the heads of years and at the turning points of their seasons / with the completion of their established term, at the day when its office (is transferred) from one to the other

The poetic statement of X 6–7 functions as a catchphrase for the subsequently-recorded times of prayer in the various agricultural seasons: harvest, summer, seedtime, etc. More specifically, this statement embodies the very heart of the dialectic in the ever-recurring transfer of authority from one season to the next. This is expressed by the consistent use of the phrase זה לזה "one to the other" (lines 4, 8). Lines 7ff focus on the days of transition, on which the sun reaches its cardinal points and the seasons change. These days possess a special import in their dynamic capacity for engendering change and continuity. Talmon has already noted how the present scene, in which

[68] M. Eliade, *The Myth of the Eternal Return: Cosmos and History* (trans. W.R. Trask; NY: Harper and Row, 1959).

the seasons pass on their term of office to their replacements, echoes a similar scene in *1 En* 82:9ff, where the various leaders sequentially alternate in time.[69] Since a similar scene is also implied in *Jub* 6:23–29, it can be concluded that the liturgy of the *yaḥad* continues traditions from *1 Enoch* and *Jubilees* in relation to the cardinal days of the year.

This ideology is by no means restricted to the *Serek*. Times of seasonal prayer are also marked in the purification rituals of 4Q284 and 4Q512. The latter contains expressions especially reminiscent of the agricultural terminology known from *1 Enoch* 82 and the *Serek* hymn. Thus 4Q512 33:[70]

1] ולמועד שבת בש[בתו]ת לכול שבועי

2 ו]מוע[ד... ו]ארבעת מועדי

3 ו]מועד ק[צ]יר וקיץ ור[וש ח]ודש א

1] and for the appointed time of the Sabbath, on the Sabbaths of all the weeks of …

2 [and] the appointed ti[me of … and] the four festivals of …

3 [and] the festival of h[ar]vest {and of summer} and the beg[inning of m]onth 1 (= the first month)[71]

[69] Talmon, "The 'Manual of Benedictions' of the Sect of the Judaean Desert," 486ff. Other scholars have also detected references to the cardinal days of the year in this hymn, especially in the terms מועד and אות: see Vermes and Alexander, DJD XXVI, 120; Albani, *Astronomie und Schöpfungsglaube*, 86 n. 136; Licht, *The Rule Scroll*, 205, 209; Nitzan, *Qumran Prayer and Religious Poetry*, 57; Falk, *Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls*, 188.

[70] The transcription follows Baillet, DJD VII, 264; cf. *DSSR* 5, 462. Times of prayer are also mentioned in 4Q512 frgs. 1–6, 17, 29–32, and possibly 45, 77. "מועדי דשא festivals of sprouting grass" are also mentioned in 4Q509 frg. 3, with a possible reconstruction of "מועדי זרע festivals of seed." For the entire topic, see M. Satlow, "4Q502 A New Year Festival?," *DSD* 5 (1998): 57–68, esp. 61.

[71] Although the letter *aleph* is visible on the photo at the end of line 3, followed by a blank space, indicating that no letters followed it, the rendering of this sign as "the first month" (Baillet, as maintained in *DSSR* 5) is doubtful. In Qumran, calendar months are never indicated by numerical signs but always by a word, whether a month name or a sequential number, such as רישון, שני, etc.

Additional information appears in 4Q284, a scroll which demonstrates significant links to 4Q512 and 4Q414.[72] 4Q284 frg. 1 3–5 (DJD XXXV, 124ff slightly altered) reads:

3] ש]בׄתׄ לׄכׄול [שב]וׄעי

4] השנה ו]שנׄים עשר חׄודשיה

5] וארבעת מו]עׄדי הׄשנה בימי

3 [Sa]bbath of each of the [wee]ks of

4 [of the year and] its twelve beginnings of months

5 [and the four sea]sons of the year on the days of …

The above compositions assign fixed timed for acts of purity which overlap with the cardinal days. This is further evidence for the continuity of a calendrical concept from AB and *Jubilees* through to the Qumran literature.

1.3.4 *Calendrical Texts from Qumran*

The calendrical scrolls from Qumran have preserved two reasonably clear cases of concluding formulas for the *tequfah* and the whole year. Another less clear case is also presented below. The three scrolls quoted here (4Q324d, 4Q394 1–2, 4Q394 3–7)[73] belong to a type of calendrical document which mentions neither *mišmarot* nor phases of the moon and therefore has no need of a calendrical cycle of years. As it appears in this type of text, the 364DY is a purely schematic year. The day termed "additional" here is part of the mathematical equation 30+30+30+1 = 91 days in each season, and is never linked to the sun's points of transition. Furthermore, in contrast to some of the sources discussed above, this day is not called "leader" or "head."

[72] J.M. Baumgarten, DJD XXXV, 123, 125. For 4Q414, see E. Eshel, DJD XXXV, 135–54. The latter document mentions "fixed times for purification מועדי טוהר" in frg. 7 6.

[73] The fact that what is now designated 4Q394 1–2 (*olim* 4Q327) cannot be part of the same scroll as the MMT copy 4Q394 frgs. 3–7 is demonstrated in DJD XXI, 155ff. See further J.C. VanderKam, "The Calendar, 4Q327, and 4Q394," in *Legal Texts and Legal Issues: Proceedings of the Second Meeting of the International Organization for Qumran Studies, Cambridge 1995. Published in Honor of Joseph M. Baumgarten* (STDJ 23; ed. M. Bernstein et al.; Leiden: Brill, 1997), 179–94.

4Q394 1–2 ii 3–14 (DJD XXI, 162)

[ב]עׄשרים ושמונה ב[ו] שבת עליו אחר השבת וׄ[יו]ם השנׄ[י ויום נוסף ושלמה
התקופה תשעים ואחד יום]

> [on] the twenty-eighth in [it (= the third month)] Sabbath. Onto it (add) the day after the Sabbath (i.e., Sunday), and the secon[d day (of the week), and an additional (= epagomenal) day, and the season is complete, ninety-one days]

4Q394 3–7 i 1–3 (DJD X, 8; my translation)

[בעשרים ושמונה בו]שבת ע[ל]וׄ אׄחר [ה]שׄ[בת ויום השני ויום נו]סׄף ושלמה
השנה שלוש מאת ושׄ[שים וארבעה] יׄום

> [on the twenty-eighth in it (= the twelfth month)] Sabbath. U[nt]o it (add) the day after [the] Sab[bath (i.e., Sunday) and the second day (of the week), and an addi]tional (= epagomenal) [day] and the year is complete, three hundred and si[xty-four] days

4Q394 1–2 describes the end of the first annual season, which overlaps the end of month III, while 4Q394 3–7 refers to the end of the year = end of month XII. Both scrolls make use of the correspondence between the days of the week and annual dates (see below 1.4.5). As a result of the unique structure of the 364DY, a Sabbath will always occur on day 28 of those months which conclude seasons (III, VI, IX, XII). The above-quoted formulas record this Sabbath and go on to count the weekdays which follow it until the end of the *tequfah*: "the (day) after the Sabbath" (i.e., Sunday the 29th); "and the second day" (i.e., Monday the 30th); "and an additional day" or "and a third additional [day]" (ויום נוסף or ושלישי נוסף), the Tuesday which concludes the season. This day, number 31 in the month, is here explicitly designated by the Hebrew term נוסף "additional" (cf. *1 En* 75:2, 82:4).

Several other formulas belonging to the end of the *tequfah* are preserved in the encrypted document 4Q324d cryptALiturgical Calendar[a].[74] The fullest formula, preserved in frg. 3 ii 3, appears to record a *tequfah* on the fourth day of the week: י[ום הרב]יעי [תׄקופׄ]ה. This may attest to the celebration of a *tequfah* day at the beginning of the incoming season, comparable to the statement in *Jub* 6:23–29 but

[74] No official transcription of this document has been published in DJD. The PAM plates have been reproduced in DJD XXVIII, plates LIX–LX. The quotation here follows the reading by Abegg, *DSSR* 4, 54–55.

incongruent with the evidence of the two documents quoted above. Since this reading of line 3 fails to make sense in the framework of the entire fragment, it cannot supply conclusive evidence.[75] The general trend in calendrical texts from Qumran is thus to place the "additional day" at the end of the season, although the ambiguity of *1 Enoch* 82 with regard to the place of the cardinal days may also be reflected in an isolated calendrical manuscript.

1.3.5 *11QPs[a] XXVII*

The text commonly titled "David's Compositions" is preserved on column XXVII of 11QPs[a].[76] We shall discuss this passage with regard to days of *tequfah* as represented in the *Serek* hymn and in the calendrical scrolls, without reference to other calendrical implications which may arise from the overall structure of 11QPs[a].[77] Although 11QPs[a] was penned in the early first century C.E., the selection of psalms it contains most probably dates from an earlier period since its text is paralleled in other copies.[78] Given that no clear sectarian signs appear in it, this compilation apparently antedated the *yaḥad*.[79]

[75] 4Q324d contains enumerations of Sabbaths and festivals according to a method similar to that employed in 4Q326. Given that it is difficult to envision how a scroll of this kind, when relating to the date 1/VII, would not refer to it as יום הזכרון but rather only as תקופה, the reconstruction of this scroll deserves further attention. It should also be noted also that in Abegg's transcription the numbering of cols. i–ii is reversed compared to the numbering on the plates in DJD XXVIII, Plate LIX.

[76] This column is renumbered as number 36 in the recent reconstruction by U. Dahmen, *Psalmen- und Psalter-Rezeption im Frühjudentum: Rekonstruktion, Textabstand, Struktur und Pragmatik der Psalmenrolle 11QPs[a] aus Qumran* (STDJ 49; Leiden: Brill, 2003), 97–99.

[77] P.W. Flint, *The Dead Sea Psalms Scrolls and the Book of Psalms* (STDJ 17; Leiden: Brill, 1997), 172–201; R.T. Beckwith, *Calendar and Chronology, Jewish and Christian: Biblical, Intertestamental and Patristic Studies* (AGAJU 33; Leiden: Brill, 1996), 141–66.

[78] 11QPs[b] is most probably a copy, as is possibly 4QPs[e]: see Flint, *The Dead Sea Psalms Scrolls and the Book of Psalms*, 159–64; Dahmen, *Psalmen- und Psalter-Rezeption im Frühjudentum*, 51–58.

[79] See the updated view of Flint, *The Dead Sea Psalms Scrolls and the Book of Psalms*, 198–201. In addition, while the "Hymn to the Creator" from 11QPs[a] XXVI reflects affinities with *Jub* 2:2–3 and some sectarian literature, it is also quoted in the apparently sectarian composition preserved in 4Q370 Admonition Based on the Flood.

The pericope on “David’s Compositions” opens with an account of David’s special virtues as a wise man of God and a poet and then proceeds to a numerical record of the songs he authored. After counting 3,600 תהלים “psalms” (?) the text goes on to recount various other psalmic compositions written for the festival services—450 in number. The overall number of Davidic compositions comes to 4,050.[80] The count of festival psalms is inherently connected to the 364DY, the numbers being fixed according to various units of that year: 364 songs for the days of the year, 52 songs for the Sabbaths, 30 songs “for the sacrifice of the heads of months and for all the festival days and for the Day of Atonement.”[81] Finally “four songs for playing on the *pgwʿym*” are numbered. Based on the fact that the 364DCT was employed by the original author to determine the numbers of songs, we can now further expand on two additional aspects of this interpretative principle.

The number of 3,600 songs has been the subject of a variety of interpretations in scholarly research.[82] Earlier scholars saw the figure as a multiple of the 150 psalms of David, 24 x 150 equaling 3,600, associating the number 24 with the order of the 24 priestly courses—an important component of the 364DCT. Alternatively, the figure may stand for the numerical value (gematria) of the word דויד, written *plene* as common at Qumran. Having weighed these suggestions carefully, VanderKam concluded that the level of numerical manipulation they contain is too great to be tenable.[83] He thus prefers Brownlee’s attempt to explain 3,600 as an expansion of the 360 days

[80] An early study of this passage revealed most of the relevant topics contained in it: see W. Brownlee, “The Significance of ‘David’s Compositions’,” *RQ* 5 (1964/1966): 569–74. For two recent treatments, see S. Talmon, “The Covenanters’ Calendar of Holy Seasons according to the List of King David’s Compositions in the Psalms Scroll from Cave 11 (11QPs[a] XXVII),” in *Fifty Years of Dead Sea Scrolls Research: Studies in Memory of Jacob Licht* (ed. G. Brin and B. Nitzan; Jerusalem: Yad Ben Zvi, 2001), 204–19; J.C. VanderKam, “Studies on ‘David’s Compositions’,” *EI* 26 (1999): *212–*220. The number 4,050 clearly relates to the count of Solomonic compositions in 1 Kgs 5:12, which comes to 4,005 (MT) or 4,500 (LXX), although the precise relationship between the figures has not been resolved.

[81] For two of the suggested interpretations of this figure, see the works by Talmon and VanderKam mentioned in the previous note.

[82] See the survey by VanderKam, “Studies on ‘David’s Compositions,” *214–*16.

[83] It is doubtful to what extent, if any, gematria was practiced at such an early period. Further, the number of 150 psalms had not yet become fixed in Jewish sources, as proven by differing counts of the psalms: see N.M. Sarna, *Encyclopedia Miqraʾit* s.v. “psalms, Book of” (Jerusalem: Bialik Institute, 1982), 8:439ff (Hebrew).

of the year.

VanderKam connects the appearance of the 360-day year here with its occurrences in AB (74:10–17, 75:2) and in other Second Temple literature. Although the author clearly states: "… for all the days of the year—364," the use of the number 360 proves that he was also aware of the latter number. The calendar experts who propagated the 364DY were correspondingly familiar with the fact that it revolves around the number 360, together with the four additional *tequfah* days. The latter being noted separately in the same passage of "David's Compositions," it is thus apparent that despite the existence of a time-honoured 364-day calendar tradition, covering a multitude of calendrical documents, calendar experts continued to give prominence to the number 360.

At the end of the count, special place is made for "songs to play over the פגועים—four." Brownlee's interpretation of this term generated a considerable amount of later scholarly attention.[84] Following the use of the term *peguᶜim* in rabbinic Hebrew and in other texts from Qumran (notably 4Q511), it is generally accepted today that it is connected with demonic activity in some way. The four songs mentioned are thus to be understood as a liturgy for exorcising demons, performed with the help of musical instruments. At the same time, we may also be justified in applying the calendar as an exegetical principle here, as explained above, and seeing in the four *peguᶜim* representations of the cardinal days. This interpretation is based on the etymology of *pgᶜ*—"to meet, touch" (referring to the turn of the seasons)—but also "to pray" (cf. Jer 7:16), these days being dedicated to prayer.[85] The two interpretations may also be combined: the liminal period at the turn of the seasons was considered

[84] Brownlee, "The Significance of 'David's Compositions'," 570; Nitzan, *Qumran Prayer and Religious Poetry*, 238; Talmon, "The Covenanters' Calendar of Holy Seasons," 215–19; VanderKam, "Studies on 'David's Compositions'," *218; see also the bibliography given in these publications.

[85] J. Maier, "Shîrê ᶜÔlat ha-Shabbat: Some Observations on their Calendric Implications and on their Style," in *The Madrid Qumran Congress* (STDJ 11; ed. J. Trebolle Barrera and L. Vegas Montaner; Leiden: Brill, 1992), 2:552, points out the intriguing similarity between the Hebrew root *pgᶜ* and the Greek term ἐπαγόμεναι (from ἐπάγω), used to denote the added days at the end of the Egyptian civil year. Following the Greek, the intercalated month in the Ethiopian calendar is also designated *p̣āgwmen*. While the similarity seems too close to be coincidental, an inter-lingual influence at this stage seems rather farfetched.

particularly felicitous for the action of demons and thus required the institution of special prayers and rituals.[86] Finally, it should be noted that since the place of the פגועים within each season—whether at its beginning or its end—is not specified in 11QPs[a] XXVII, scholars are left with the same ambiguity noted above with regard to the place of the cardinal days.

1.3.6 *Summary: The Turn of the Seasons and the Cardinal Days*

The discussion thus far has proven the centrality of the four cardinal days in the 364DCT. At the same time, it has underscored the ambiguity which prevailed with regard to their placement within the year, as well as the basic question of whether or not they are included in the total number of days in a year. This ambiguity prevails through to the latest stages of the calendar tradition. While the days of *tequfah* were intended to reinforce the correlation of the schematic year with the four annual seasons, the ideal scheme of 360 days did not entirely disappear from calendrical and liturgical texts. The four *tequfah* days were noted separately from the 360 "normal" days of the year and were specifically marked as fixed times for prayer and purification.

1.4 The Septenary Principle

The septenary principle being central to the 364DCT, it is essential to examine where it was used and to what extent. The septenary traits of the calendar played an important part in later stages of the 364DCT—the *yaḥad* literature, *mišmarot*, and the *Songs of the Sabbath Sacrifice*—and to a somewhat lesser extent in earlier stages of the tradition, i.e., in AB and *Jubilees*.

[86] See A. Spalinger, "Some Remarks on the Epagomenal Days in Ancient Egypt," *JNES* 54 (1995): 33–47; Leitz, *Tagewählerei*, 416–27.

Numerical relations constitute a central concept in AB. Albani has noted the existence of two numerical systems with regard to the motion of the sun and the moon: While the sun operates on a sexagecimal basis, the moon's motion, as well as its waxing and waning, is founded upon a septenary basis.[87] The original arithmetical contribution of AB was the merging of the two systems, enabled by the addition of four epagomenal days, thereby achieving the perfect septenary number of 364. Seven (or its multiple, fourteen) represents the number of parts of light in the moon in the various versions of AB.[88] This is backed by programmatic statements such as 74:3, or 4Q209 1 iii 6 ודבר ירחיא בפלגי שביעין "and it (the moon) accomplishes (lit. guides) (its) phases by halves of sevenths" (trans. Milik, but cf. below 2.2.4). Accordingly, the key points in the moon's orbit also occur roughly every seven days.[89] The number of fourteen lunar phases strongly attests to AB's commitment to the septenary count, since in the Mesopotamian antecedents for this kind of lunar treatise the advancement of the lunar orbit is measured in fifteen parts, a number that better fits the ideal month (see below 4.1.5). It may well be that the number fourteen is preferred over fifteen due to the Jewish author's septenary ideology.

Albani connects the septenary tendency with the growing importance of the Sabbath during the Babylonian exile.[90] In this respect, the calendar of AB served both as an ideal sabbatical framework for the calendar and as a reasonably accurate schematic model for the orbits of the luminaries. According to Albani, the main appeal of the original Babylonian number 364 in the eyes of the

[87] Albani, *Astronomie und Schöpfungsglaube*, 278–80.

[88] The Aramaic fragments count seven parts of light, with half a part being revealed or covered every day. The Geez AB, as well as 4Q317, counts fourteen parts, as possibly does the Greek text of *1 En* 78:8: see J.T. Milik, "Fragments grecs du livre d'Hénoch [p.Oxy. XVII 2069]," *Chronique d'Egypt* 91 (1971), 339. For an evaluation of this fragment, see Knibb, *The Ethiopic Book of Enoch*, 2:20–21. *1 En* 78:7 mentions fifteen parts of light, in similar fashion to the ancient Mesopotamian lunar theory in EAE 14.

[89] Cf. *Enūma Eliš* V 15–22; B. Landsberger, *Der kultische Kalender der Babylonier und Assyrer* (Leipzig: J.C. Hinrichs, 1915), 97–100. The number seven also appears in *1 Enoch* 77 as the number of mountains, rivers, and islands.

[90] Albani, *Astronomie und Schöpfungsglaube*, 280.

Jewish author was its septenary features, which already existed in Mul.Apin and were subsequently introduced into Jewish literature.

While AB is in many ways indebted to septenary ideology, however, the actual data in AB do not confirm all of Albani's conclusions. Sabbatical units in AB are peripheral at best, and are even more conspicuously missing from Mul.Apin.[91] AB completely neglects to mention the division of the year into fifty-two weeks. While the Greek authors Syncellus and Cedrenus do ascribe this division to Enoch, they appear to rely more on *Jubilees* than on actual versions of AB.[92] The numerical harmony of AB is thus based on the four-part division of the year and the number of thirty days in each month, with no reference to the septenary element.

79:4 mentions a count of weeks (*śərʿāta sanbat*): "… until 177 days are completed, by the law of the week (or: by arrangement in weeks[93]) twenty-five (weeks) and two days."[94] Since this reckoning is applied to the days of the lunar year rather than to the 364DY, as might have been expected, it would appear that although the authors of AB knew the concept of units based on sevens, this has little association with the septenary harmony of later calendrical documents. Even Klaus Koch, who celebrated the septenary structure as a key concept of apocalyptic chronography, acknowledged that it is difficult to identify this concept in AB.[95] As an example he cites the

[91] The evidence which Albani adduces from Mul.Apin (*Astronomie und Schöpfungsglaube*, 278) merely demonstrates that the Babylonian author knew the number 364, not that he adopted the septenary count. On the contrary, Mul.Apin ignores the number seven in a series of data regarding the shadow length at the turn of the seasons (II ii 21–42): see Glessmer's argument in "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," 264, n. 17, and the counter argument by H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (HdO I, 44; Leiden: Brill, 1999), 79.

[92] Syncellus and Cedernus are quoted by M. Black, *Apocalypsis Henochi Graece* (SVTP 3; Leiden: Brill, 1970), 12.

[93] Olson, *Enoch: A New Translation*, 166.

[94] See the synopsis in Koch, *Vor der Wende der Zeiten*, 11. The Aramaic fragment 4Q209 26 (DJD XXXVI, 163) does not preserve the beginning of line 3, where the phrase "law of weeks" is expected, but only the later part of the verse: "וי]ומין תרין and t]wo days."

[95] On septenary chronography, see Koch, *Vor der Wende der Zeiten*, 45–106; on AB, see ibid, 30. While A. Yarbro-Collins, *Cosmology and Eschatology in Jewish and Christian Apocalypticism* (JSJSup 50; Leiden: Brill, 1996), 101–3, similarly points out the importance of the number seven in *1 Enoch*, her evidence regarding AB is inconclusive.

above-quoted passage from *1 En* 82:9–14, where one finds leaders for the days and months but not for the weeks. For the sake of comparison, it should be noted that in the Qumran hierarchy (DJD XXI, 29), the priestly courses structure the time periods according to a clearly septenary structure. Furthermore, *1 Enoch* never dates an event according to the days of the week. In sum, although AB was indebted to septenary models, this is primarily apparent in the lunar models of the book; it does not attest to other, more characteristic, components of the septenary ideology.

Two such "traditional" septenary aspects of the 364DCT, both absent from AB, are: 1) the role of the multi-week chronologies; and 2) the concomitant recording of the days of the week. Neither of these elements are present in AB, in contrast to their frequent presence in later sources, both Jewish and non-Jewish.[96]

1.4.2 *Sabbaths and Festivals*

An important example of the reckoning of the year on the basis of full weeks is found in the statutes regarding harvest festivals in the *Temple Scroll* (11QT[a] XVIII–XXIII). These ordinances proceed from the biblical commands (Lev 23:15–17; Deut 16:9) of counting seven weeks from the waving of the new sheaf at harvest time and concluding that count either with the Festival of Weeks (Deuteronomy) or with the sacrifice of two loaves of wheat bread (Leviticus). The first sheaf was understood at a very early stage to mark the festival of the barley harvest and the Festival of Weeks as a wheat harvest festival.[97] The *Temple Scroll* added two new festivals to the biblical requirement of a sheaf and loaves of bread, instructing the counting of two additional consecutive cycles of seven weeks, with an additional harvest festival concluding each of these periods—one for

[96] For some later examples of septenary patterns, see Elior, *The Three Temples*, 232–65; Yarbro-Collins, *Cosmology and Eschatology in Jewish and Christian Apocalypticism*, 55–138.

[97] It is surprising that, despite its extensive treatment of the Festival of Weeks, *Jubilees* 6 does not mention the count of weeks for the harvest festival. The author of *Jubilees* rather treats this feast as a festival of covenant making, in Hebrew חג השבועות (*šewa* under the *šin*): see Ravid, "The Book of Jubilees and its Calendar – a Reexamination," 380, and bibliography there.

the new wine and one for the new oil.[98] The correlation of the 364DY with permanently-fixed days of the week dictated that all the harvest festivals fell on a Sunday, signifying that the count of weeks included only "full" weeks, which begin on Sunday and end on the Sabbath. Although this scheme is not explicit in the *Temple Scroll*, it is clear that the nature of the counted weeks constituted a major point of disagreement between the 364DCT and rabbinic sources, where the harvest weeks could also be "nominal" weeks, irrespective of the day on which they begin. Shlomo Naeh has demonstrated that the roots of this conflict date back to the biblical period, most probably originating from the disparity between the laws regulating harvest festivals in Leviticus and Deuteronomy.[99]

According to the festival calendar of the *Temple Scroll*, the first half of the year is replete with harvest festivals. This series of feasts concludes with the six-day festival of the Wood Sacrifice, which occurs at the end of the sixth month, immediately before יום הזכרון, "the day of commemoration," on 1/VII.[100] The roots of these festivals lie in late biblical literature (cf. Neh 10:35–38, 13:31), although their specific dates and duration are found only in the *Temple Scroll* and other Qumran literature. The year in the *Temple Scroll* thus seems to be dominated to a large extent by cycles of seven weeks. Hildegard and Julius Lewy, writing long before the discovery of the Qumran scrolls, claimed that this kind of "pentecontad" year was practiced in Assyrian colonies of the Old Assyrian Period, in the early second millennium B.C.E., where the year was divided into 50-day units called *ḫamuštum*. They also pointed to a similar practice in the Syrian-Nestorian Church, claiming that such a custom served as the basis for the biblical statute of counting seven weeks.[101] Although the *Temple*

98 Y. Yadin, *The Temple Scroll* (Jerusalem: Israel Exploration Society, 1985), 1:99–122; Milgrom, *Leviticus 23–27*, 2071–76.

99 See S. Naeh, "Did the Tannaim Interpret the Script of the Torah Differently from the Authorized Reading?," *Tarbiz* 61 (1992): 401–48, esp. 424–39; idem, *Tarbiz* 62 (1993): 433–62. The preference for "full" weeks expressed by R. Hiyya in *Midr LevRab* 25:2 should also be noted (ed. M. Margulies; Jerusalem: Ministry of Education and Culture, 1956), 653, and the editor's comments *ad loc*.

100 DJD XXI, 165–66; Yadin, *The Temple Scroll*, 1:122–31; Ben-Dov, "The 364-day Year in Qumran and the Pseudepigrapha," in *ʿAl Megillot Qumran* (ed. M. Kister; Jerusalem: Yad Ben Zvi, forthcoming) (Hebrew); C. Werman, "Appointed Times of Atonement in the Temple Scroll," *Meghillot* 4 (2006): 107–15 (Hebrew).

101 H. Lewy and L. Lewy, "The Origin of the Week and the Oldest West Asiatic Calendar," *HUCA* 17 (1942–1943): 1–152c. This study, which also contains a large

Scroll may add substantial support to their hypothesis, it is clear today that a pentecontad year did not exist in ancient Mesopotamia and that H. and L. Lewy's argument was based on outdated concepts.[102] The testimony of the *Temple Scroll* regarding a pentacontad reckoning nonetheless still remains valid, and even finds support from Philo's description of the Therapeutae and in later medieval sources.[103]

Baumgarten and Beckwith have demonstrated how the septenary feature of the sectarian calendar is connected to the sectarian restriction of ritual activity on the Sabbath (*Jub* 50:10–11; CD 11:17–18).[104] The sole way to ensure that no festival sacrifices are offered on the Sabbath is by adopting the 364DY tradition and its septenary character. The problem of festivals which fall on the Sabbath was a controversial issue in early rabbinic literature, as illustrated, for example, in the regulations regarding the slaughtering of the Pessah lamb on the eve of the Sabbath (cf. *b. Pes.* 66a). The ability to obviate such difficulties must have been quite appealing in sectarian circles. The centrality of the Sabbath in (pre-)sectarian circles consequently played a prominent role in the acceptance of 364DCT in these circles.[105]

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amount of data on septenary elements in cuneiform literature, is mostly outdated. On the Syrian calendar, see also J.M. Baumgarten, *Studies in Qumran Law* (SJLA 24; Leiden: Brill, 1977), 138–39; Yadin, *The Temple Scroll*, 1:121.

[102] The unit *hamuštum* is now understood either as a five-day unit (CAD Ḫ 74–75) or as a six-day unit (AHw 319)—i.e., one-fifth of the month, or as a seven-day unit: see K.R. Veenhof, "The Old Assyrian Hamuštum Period: A Seven-day Week," *JEOL* 34 (1995/1996): 5–26; H. Klengel, "Vorstellungen von Zeit und Zeitmessung und der Blick auf vergangenes Geschehen in der Überlieferung des alten Mesopotamien," in *Vom Herrscher zur Dynastie: Zum Wesen kontinuierlicher Zeitrechnung in Antike und Gegenwart* (ed. H. Falk; VSAO 1; Bremen: Hempen, 2002), 6–26, esp. 14.

[103] Yadin, *The Temple Scroll*, 1:119–22.

[104] Baumgarten, *Studies in Qumran Law*, 114, 127–28; Beckwith, *Calendar and Chronology*, 103ff; L. Doering, "The Concept of the Sabbath in the Book of Jubilees," in *Studies in the Book of Jubilees* (TSAJ 65; ed. M. Albani, J. Frey, and A. Lange; Tübingen: Mohr Siebeck, 1979), 197–98, and the bibliography there.

[105] This phenomenon has several further implications regarding the 364DCT. Firstly, the fact that the Sabbath occurs within the festivals of Pessah and Sukkot may be the reason why only the first days of these feasts are recorded in the festival calendars of 4Q320 and 4Q321, despite the fact that the entire seven-day sequence is prescribed in 11QT[a] XVII, XXVIII. Secondly, two marginal festivals in the Qumran calendar—those of the priests' investiture מילואים and the Wood Sacrifice—raise a problem with regard to sacrifices on the Sabbath. Both festivals involve ritual acts which necessarily occur also on a Sabbath: see Ben-Dov, "The 364-day Year in Qumran and the Pseudepigrapha." Medieval Karaite sources give instructions for the cessation of these festivals over the Sabbath, causing the entire festival to last one day

Further examples of the septenary structure of the year come from the liturgical composition "Songs of the Sabbath Sacrifice," attested in numerous Qumran copies and one Masada copy.[106] This composition contains thirteen songs, one for each of the Sabbaths within a *tequfah*.

The septenary time system was a constitutive principle of the calendar, dating back as it does to biblical prooftexts where one also finds hints of a calendrical controversy.[107] The issue became full-blown once again in apocalyptic texts of the third to first centuries B.C.E., owing to the novel conceptualization of the septenary principle, already well-rooted in Jewish sources, and now combined with new scientific ideas originating in Mesopotamia.

1.4.3 *The Number Seven in Long-term Time Reckoning*

The septenary principle played a part not only in the internal construction of the year but also in the design of longer year-cycles.[108] The *šemitah* and jubilee cycles (7 and 49 years respectively) are employed in apocalyptic literature to construct frameworks for world history, both past and future. This literary genre is based on reinterpretations of the biblical seventy-year prophecy (Jer 25:11–12, 29:10) and is found in Dan 9:24–25, in Levi literature, the Apocalypse of Weeks (*1 En* 93:1–10, 91:11–17), the Animal Apocalypse (*1 Enoch* 85–90), the *Book of Jubilees*, and the Qumran compositions CD, 4Q180, 4Q181, 4Q247, 4Q385–390, and 11Q13 (Melchizedek).[109]

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longer: see Yadin, *The Temple Scroll*, 1:130; Y. Erder, *The Karaite Mourners of Zion and the Qumran Scrolls: On the History of an Alternative to Rabbinic Judaism* (Tel Aviv: Haqibutz haMe'uhad, 2004), 127–32 (Hebrew).

[106] C. Newsom, DJD XI, 173–401.

[107] The septenary principle should thus be added to the data in L.H. Schiffman, "Pre-Maccabean Halakhah in the Dead Sea Scrolls and the Biblical Tradition," *DSD* 13 (2006): 348–61.

[108] For this distinction, see J. Ben-Dov, "Jubilean Chronology and the 364-Day Year," *Meghillot* 5–6 (2007): 49–59 (Hebrew).

[109] See generally, D. Dimant, "The Seventy Weeks Chronology (Dan 9,24–27) in the Light of New Qumranic Texts," in *The Book of Daniel in the Light of New Findings* (BETL 106; ed. A.S. Van der Woude; Leuven: Peeters, 1993), 57–76; idem, DJD XXX, 113–15; Yarbro-Collins, *Cosmology and Eschatology in Jewish and Christian Apocalypticism*, 58–63; VanderKam, "Sabbatical Chronologies in the Dead Sea Scrolls and Related Literature," in *The Dead Sea Scrolls in their Historical Context* (ed. T. Lim; Edinburgh: T&T Clark, 2000), 159–78; Beckwith, *Calendar and Chronology*, 217–75; C. Werman, "Epochs and End-time: The 490-year Scheme in

One of the earliest attestations of the genre, the Apocalypse of Weeks, is usually dated to the second century B.C.E., around the period of the Maccabean revolt.[110] It is therefore clear that already from the early second century B.C.E. onwards the septenary principle exercised considerable influence on apocalyptic long-range time reckoning.

Septenary time periods were not only used for apocalyptic chronology, however, but also for quotidian time reckoning. Examples of this can be found in the rabbinic dating of the destruction of the Second Temple in Jerusalem to a post-sabbatical year (מוצאי שביעית),[111] as well as in the paleographic finds of the Ṣoʿar tombstones, remains of a Jewish cemetery from the fifth century C.E. and onwards.[112]

While the 364DY was not created as a septenary construct, it was easily identified as such and consequently adopted and developed in various apocalyptic circles. At the same time, a long-range septenary chronology also emerged in these circles. The two time-reckoning systems functioned side by side in Enochic compositions and in Qumran literature.

1.4.4 *Counting of Weeks and of the Days of the Week in the* Book of Jubilees

As opposed to AB, where the 364DY is not defined in units of weeks, *Jub* 6:30 clearly presents a septenary definition of the year: "All the days of the commandments will be 52 weeks of days; (they will make) the entire year complete (*wakʷəllo ʿāmata fəṣṣuma*)." The "weekly" definition of the year is preferred here over its more common

Second Temple Literature," *DSD* 13 (2006): 229–55. For signs of the Enochic septenary chronology in Ethiopic literature, see Neugebauer, *Ethiopic Astronomy and Computus*, 226, 229.

[110] VanderKam, "Sabbatical Chronologies," 164; Nickelsburg, *1 Enoch 1*, 427.

[111] See *t. Taʿan*. 3:9 and parallels (ed. S. Liebermann; NY: JPS, 1962), 3:340.

[112] For the *šemitah* count, see S. Stern, *Calendar and Community: A History of the Jewish Calendar 2nd Century B.C.E.—10th Century C.E.* (Oxford: Oxford University Press, 2001), 89–93, 137–38, 146–50, and the bibliography cited there. A different type of *šemitah* count also appears in 4Q319—a scroll which combines the sexennial calendrical cycle with the *šemitah* cycle, although the *šemitah* does not appear to be used there for historical or chronological purposes: see Ben-Dov, "Jubilean Chronology and the 364-Day Year."

definition using quarters and months. We noted above that *Jubilees* preserves the tension between the 360- and 364-day years, producing an ambiguity with regard to the placement of the *tequfah* days. The author of *Jubilees* fails to mentions a 31-day month, since he was reluctant to count the additional days with the months to which they are adjoined.[113] In other words, in *Jubilees* the additional days stand within the count of the year but outside the count of months. In 6:29–30, the author therefore chose to define the 364DY and its quarters in terms of weeks rather than months. In his eyes, fifty-two weeks together comprise a "complete" year.[114]

In a series of studies from the 1950s, Annie Jaubert contributed many new insights to the understanding of ancient Jewish calendars.[115] Concurrently, the first publication of calendrical fragments from Qumran demonstrated that the calendrical system employed by AB, *Jubilees*, and Qumran was similar. Jaubert devised TABLE 0.1, which still remains the most accurate and simplest depiction of the schematic calendar. Based on the supposition that the year begins on the fourth day of the week—the day when the luminaries were created to mark the beginning of the march of Time—Jaubert was able to point out the correspondence between dates in the 364DY and the days of the week. When studying the dates in the priestly passages of the Pentateuch, she came upon two surprising finds: a) according to the biblical narratives, the Israelites never traveled on the Sabbath day; and b) the events recorded in the Pentateuch and in *Jubilees* occur primarily on three significant days of the week—1, 4, and 6. On the basis of this evidence, Jaubert concluded that the 364DY constituted the norm in Israel in ancient times, notably amongst the temple priesthood in the Persian period, but possibly also earlier, the luni-solar 354-day year only being introduced later.

Jaubert's method has been discussed in numerous publications, with ambivalent responses, indicating that it is indeed possible but not

[113] *Jubilees* appears acquainted only with 30-day months, a fact which may account for the awkward equation of 5 months = 150 days in the flood narrative (*Jub* 5:27): see Ravid, "The Book of Jubilees and Its Calendar," 381; Boccaccini, "The Solar Calendars of Daniel and Enoch," 319.

[114] Cf. the same phrase with regard to the number 364 in 4Q252 II 3.

[115] Conveniently collected in A. Jaubert, *The Date of the Last Supper* (trans. I. Rafferty; Staten Island: Alba House, 1965).

necessarily correct.[116] Surprisingly, while her schemes worked perfectly when applied to calendrical documents from Qumran, her method encountered difficulties when applied to *Jubilees* itself.

Despite the enormous number of date formulas within *Jubilees*, the days of the week are not noted even once! Furthermore, no indication exists in *Jubilees* that the year begins on Wednesday, nor that it is correlated in any way with the days of the week.[117] Even VanderKam, who generally accepts Jaubert's views, acknowledges that this constitutes a significant weakness in Jaubert's argument.

Not only are the days of the week absent from *Jubilees*, but the Sabbath itself is never mentioned in its narratives. While Sabbath laws are significant for the book's framework (2:17–33, 50:6–13), they are irrelevant in the narrative episodes.[118] Although Doering plausibly sees in *Jub* 50:1 a reference to the biblical story of the gathering of the manna in Exod 16:1,[119] this verse plays no part in the chronological framework of the book, nor does it contain any date formula. Had the author wished to underscore the message of Exodus 16, he might have been expected to recount it in the flow of his narrative.

In addition, none of the cases brought by Jaubert and VanderKam for Sabbath observance in *Jubilees* are indisputable, as demonstrated most prominently by Baumgarten and B.Z. and S. Wacholder. Baumgarten has successfully shown how in several places in the book

[116] Baumgarten, "The Calendar of the Book of Jubilees and the Bible," in *Studies in Qumran Law*, 101–14; idem, "Some Problems of the Jubilees Calendar in Current Research," *VT* 32 (1982): 485–89; J.C. VanderKam, "The Origin, Character and Early History of the 364-Day Calendar: A Reassessment of Jaubert's Hypothesis," in *From Revelation to Canon* (JSJSup 62; Leiden: Brill, 2000), 81–104 (cf. also ibid, 105–27); B.Z. Wacholder and S. Wacholder, "Patterns of Biblical Dates and Qumran's Calendar: The Fallacy of Jaubert's Hypothesis," *HUCA* 66 (1995): 1–40; P.R. Davies, "Calendrical Change and Qumran Origins: An Assessment of VanderKam's Theory," *CBQ* 45 (1983): 80–89; Ravid, "The Book of Jubilees and Its Calendar."

[117] Baumgarten, *Studies in Qumran Law*, 106; VanderKam, *From Revelation to Canon*, 93–94; Ravid, "The Book of Jubilees and Its Calendar," 376–77.

[118] Ravid has claimed that the Sabbath pericope in *Jub* 50:6–13 was added to the original book by a later *yaḥad* author: "The Relationship of the Sabbath Laws in Jubilees 50:6–13 to the Rest of the Book," *Tarbiz* 69 (2000): 161–66 (Hebrew). Her argument is disputed in detail by L. Doering, "Jub 50:6–13 als Schlussabschnitt des Jubiläenbuchs—Nachtrag aus Qumran oder ursprünglicher Bestandteil des Werkes?," *RQ* 20 (2001/2): 359–87.

[119] Doering, "Jub 50:6–13 als Schlussabschnitt des Jubiläenbuchs," 189–91.

the Sabbath is in fact profaned.[120] Even when *Jubilees* relates to an occasion longer than a week, a period which must have contained at least one Sabbath, the occurrence of the Sabbath remains unnoted (e.g., the festivals in chapters 18 and 32). This is in direct contrast to the strict laws of *Jub* 50:10–11 and CD 11:17–18, which forbid the offering of festival sacrifices if they occur on the Sabbath (see 1.4.2).

We may thus arrive at the following evaluation of the significance of the Sabbath and the week in the *Book of Jubilees*. While the author invokes a weekly-based definition of the 364DY in chapter 6, he is unfamiliar with the correspondence of annual dates with the days of the week and does not mention the Sabbath day as an element in his narratives. The Sabbath and the week are only present at isolated points of the book: chapters 2 and 50 (Sabbath), chapter 6 (week). The author is thus committed to the septenary ideal on the one hand but conspicuously independent of it on the other. The tendency of *Jubilees* to ignore the days of the week concords with the tendency of AB and of the calendrical notations in ALD (see above 1.3.2). In the early stages of the 364DCT, therefore, the days of the week did not constitute a central element of calendar reckoning. In those early stages, the septenary principle was present in other elements, such as the lunar models of AB, the long-term time reckoning, and the count of weeks within the year.

1.4.5 *The Days of the Week in the Qumran Texts*

In contrast to AB and *Jubilees*, texts from Qumran take strict note of the day of the week on which the events mentioned in them occurred. This notion may be linked to the designation of weekly days in *Sir* 33:9 as ἀριθμὸν ἡμερῶν, ימי מספר. A good example is the Genesis Commentary (4Q252), which lays special emphasis on the

[120] In their above-quoted studies, Baumgarten and Wacholder dispute most of Jaubert's evidence. In addition, even what seems to be the most conclusive piece of evidence in *Jub* 29:5–7 is ambiguous: cf. Doering, "The Concept of the Sabbath in the Book of Jubilees," 183. In that story, the day of rest is practiced by Laban the Aramaite, hardly a role model for piety and halakhic observance. Moreover, as a gentile, Laban is exempt from observing the Sabbath (*Jub* 2:17–23, 50:7). It would thus appear that the one-day gap between Laban's arrival and his covenant with Jacob was inserted in order to accommodate the events of 29:6 rather than to emphasise that Laban rested on the Sabbath.

chronological framework in its account of the biblical flood narrative. In contrast to the account of the flood narrative in *Jubilees*, the author of 4Q252 meticulously notes the days of the week in each and every date formula. This detailed report structured according to the 364DY adds a considerable amount of data to the biblical account.[121] The rewriting of Gen 7:11–8:5 in 4Q252 frg. 1–2 I 3–12 is a case in point (the days of the week are underlined):[122]

בשנת שש מאות שנה לחיי נוח בחודש השני באחד בשבת בשבעה עשׄר בו ביום ההוא

נבקעו כל מעינות תהום רבה וארבות השמים נפתחו ויהי הגשם על הארץ ארבעים יום

וארבעים לילה עד יום עשׄרים וששה בחודש השלישי יום חמשה בשבת ויגברו המים

על האׄרץ חמשים ומאת יום עד יום ארבעה עשר בחודש השביעי בׄשלושה בשבת ובסוף

חמשים ומאת יום חסרו המים שני ימים יום הׄרביעי ויום החמישי ויום הששי נחה

התבה על הרי הוררט ה֯[וא יו]ם שבעה עשר בחודש השביעי והמים הי[ו]ה֯לוך וחסור

עד החודש [הע]שירי באחד בו יום רביעי לשבת נרׄא֯ו ראשי ההרים

> In the year of the six hundredth year of Noah's life, in the second month, on the first day of the week, on its seventeenth day, on that day all (the) fountains of (the) great deep burst forth and the windows of the heavens were opened and there was rain upon the earth for forty days and forty nights until the twenty-sixth day in the third month, the fifth day of the week. And the waters swelled upon the earth for one hundred and fifty days, until the fourteenth day in the seventh month, on the third day of the week. And at the end of one hundred and fifty days the waters decreased for two days, the fourth day and the fifth day, and on the sixth day the ark came to rest on the mountains of Hurarat; i[t was the] seventeenth [da]y in the seventh month. And the waters continued to decrease until the [te]nth month, its first day, the fourth day of the week the tops of the mountains appeared.

[121] See G.J. Brooke, "The Genre of 4Q252: From Poetry to Pesher," *DSD* 1 (1994): 160–79, esp. 166–67.

[122] The Hebrew text and translation follow Brooke, DJD XXII, 193ff.

Further evidence comes from 4Q317. This scroll was composed as a variation of the lunar-solar concordances in AB (see below 3.5.3). The scroll notes the day at new and full moon, as in the following example:[123]

Frgs. 1+1a ii 7–10:

בשמנ֯ה֯ בו ת֯[משול אורה ליום בתוך] הרקיע ממע֯[לארבע עשרא וחצי ובבוא השמש יכלה כול]

אורה להכס֯ות֯ [וכן יחל להגלות] באחד לשבת

On the eighth of the month, (the moon) [rules all the day in the midst] of the sky {[fourteen-and-one-half (?) (parts being obscured)}. And when the sun sets,] its light [ceases] to be obscured, [and thus (the moon) begins to be revealed] on the first day of the week

Frg. 2 28–29:

...] וכן י]ח֯ל להגל֯ות בארבע֯ה֯ ל֯שבת

[and thus (the moon) b]egins to be revealed on the fourth day of the week

Additional evidence can also be gleaned from 4Q503 Daily Prayers. This is probably a sectarian scroll, containing morning and evening prayers for consecutive days of the month.[124] For present purposes, it is important to note that the scroll places the Sabbaths at fixed points along the month, indicating that its author is aware of the connection between the order of the year and days of the week.[125] The dates of the Sabbaths are discerned from the following phrases in the scroll: מנוח קודש, “rest, holiness” (frg. 41 5), למו[עד] מנוח ות֯ע֯נ֯ו֯ג֯, “as a fest[ival] of rest and pleasure” (frg. 24 5), and בשבתות (frg. 62). Frg. 37 also mentions the phrase ק֯ודש ומנוח לנ֯[ו, “holiness and rest for u[s” with regard to day 25, in accord with the perpetual order of the 364DY. This evidence is sufficient to demonstrate the author’s knowledge of

[123] The Hebrew text, translation (slightly improved), and numbering follow Abegg in *DSSR* 4, 58–71; cf. also frg. 9 11 and the reconstruction in frg. 1+1a ii 29.

[124] For the sectarian character of this scroll, see J.M. Baumgarten, “4Q503 (Daily Prayers) and the Lunar Calendar,” *RQ* 12 (1987): 399–407. For an interpretation of its calendrical system, see in detail below 3.5.1.

[125] D. Nahman, “When Were the ‘Daily Prayers’ (4Q503) Said in Qumran?,” *Shnaton* 13 (2002): 177–83.

the correlation between the days of the week and annual dates.[126]

The correspondence of the days of the week with specific dates in the 364DCT is naturally most evident in the calendrical documents from Qumran. This is true of scrolls of all types, irrespective of whether or not they contain references to *mišmarot*. For example, see 4Q394 1–2 (DJD XXI, 162), quoted above 1.3.4:

[ב]ע֯שרים ושמונה ב[ו] שבת עליו אחר השבת ו֯[יו]ם השנׄ[י...

בעשרים ושנים בו מועד השמן אחׄ[ר הש]בת

This phenomenon is more clearly discernible in the *mišmarot* documents, where each day of the week appears side by side with the priestly course in which it occurs. We may take the sequential record of dates and days of the Pentateuchal festivals in 4Q320 4 iii 1–9 (DJD XXI, 54) as an example:

1 השנה הרישונה   מועדיה

2 ב 3 בשבת בני מעוזיה   הפסחׄ

3 בׄ 1֯ [ב]ׄ֯דע֯[יה] הנף ה[עמר]

4 ב 5 בשערים הפסח֯[השני]

5 ב 1 בישוע חג השבועים

6 ב֯ 4 במעוזיהׄ יום הזכרון

7 [ב] 6 בייריב יום הכפורים

8 [בעשרה ב]שׁביעי *vacat*

9 [ב 4 ביד]ע֯יׄה חג הסכות

> The first year—its festivals. On the third (day) in the week of the sons of Maʿoziah (falls) the Pessah; on the first (day) [in]Yedaʿ[iah] (falls) the Waving of the [first sheaf]; on the fifth (day) in Seʿorim (falls) [the second] Pessah; on the first (day) in Yešuʿa (falls) the Festival of Weeks; on the fourth (day) in Maʿoziah (falls) the Day of Remembrance; [on the]sixth (day) in Yoyarib (falls) the Day of Atonement [on the tenth in the] seventh (month) *vacat*; [on the fourth (day) in Yeda]ʿiah (falls) the Festival of Booths.

[126] Note also the possible mention of [F]riday יו[ם שש֯י in frg. 36, although the reading is too fragmentary and the place of the fragment in the material reconstruction too obscure to be conclusive. Despite the prominence it gives to the days of the week, the liturgical composition *Divrei ha-Meʾorot* (4Q504) is irrelevant for the present discussion, since it does not tie the weekly days to specific dates.

Other sections of 4Q320 note the day of the week not only for festivals but also for such astronomical events as the phases of the moon. Thus 4Q320 1 ii 5–6 (DJD XXI, 48) states:[127]

ב 2 במלכיה ל 29 ב 20 ברישון

ב 4 בישוע ל 30 ב 20 בשני

> In (day) 2 of (*mišmar*) Malkiah; for 29 (days); in (day) 20 in the first (month)
>
> In (day) 4 of (*mišmar*) Yešuʿa; for 30 (days); in (day) 20 in the second (month)

The prologues of both 4Q319 and 4Q320 describe the creation of the luminaries on the fourth day of the week, specifying also the name of the priestly course responsible for that week. Thus 4Q319 IV 10–11 (DJD XXI, 214, cf. 4Q320 1 i 1–5; 3 i) declares:

]אורה בארבעה בשׁבּ[ת

... ה]בּריאה בארבעה בגּ[מול

>]its light (came forth) on the fourth day of the wee[k
>
> … the] Creation. In the fourth (day) in Ga[mul

In summary, while earlier stages of the 364DCT failed to note the days of the week as part of the date-formulas, this practice became commonplace in Qumran. The fixed days of the week—and especially the place of the Sabbath—emerged as a clear identifying mark of the 364DCT.[128]

[127] The translations quoted here slightly update those of DJD XXI. See also the discussion in Chapter 5 below.

[128] Baumgarten, *Studies in Qumran Law*, 106, noted how the mention of the days of the week in date formulas was adopted in early Christianity. It is also important to note the practice of the Byzantine chronographer Syncellus. In the passages where he relies upon the chronology of the *Book of Jubilees*, Syncellus fills in the notation of weekdays, although they are absent from the account in *Jubilees*: see M. Kister, "Syncellus and the Sources of *Jubilees* 3," *Meghillot* 1 (2003): 127–33 (Hebrew). Finally, this practice was adopted in general Jewish circles in the Roman period: see Mark 16:2; Luke 24:1; as well as R. Katzoff and B.M. Schreiber, "Week and Sabbath in Judaean Desert Documents," *SCI* 17 (1998): 102–14.

1.5 Conclusion

We have argued in this chapter for the stability and continuity of the 364DCT texts from AB until the latest-dated sources in Qumran. Such a synchronic analysis was necessary in anticipation of the diachronic treatment provided in the following chapters. In distinction to those views which tend to identify a plurality of 364-day calendar traditions, we have sought to demonstrate that the models encountered in various sources adhere to one basic tradition. Development and change are indispensable even for the strictest tradition if it desires to maintain its existence, and calendrical teaching constitutes a good example of this principle. Despite the fact that calendar experts consistently reconsidered their paradigms and updated them according to their needs, we maintain that all of these writers shared similar annual festivals and calendrical events and were guided by contiguous ideological and mathematical principles. The only significant exception from this rule is the calendar in the *Book of Jubilees*, where the author displays a notably independent mode of thought, although his basic notion emerged from earlier sources of the Jewish 364DCT.

CHAPTER 2

LUNAR THEORY AND THE COMPOSITION OF AB

2.1 THE PROBLEM OF AB'S COMPOSITION AND LITERARY IDENTITY

In 1992, Florentino García Martínez examined the implications of the Aramaic Enoch fragments for understanding the history of *1 Enoch*.[1] In the section he devoted to AB, he raised an insightful question regarding the existence of a coherent astronomical book in Aramaic at an early period. Earlier, Milik had contended that a fully-coherent AB already existed in the late third century B.C.E., while in response Black argued that astronomical material in Aramaic existed only as scattered pieces of information, and that a full "astronomical book" was first produced by a Greek scribe, who collected various translated fragments and edited them into a more-or-less meaningful sequence.[2] García Martínez subsequently raised a series of additional questions with regard to AB. Although he provides no absolute answers to all the issues involved, García Martínez is inclined to accept Milik's basic argument, if not all its details. He concludes that a coherent astronomical composition did exist at an early stage, although its identity as an apocalypse was only created later, through the addition of the narrative and admonition in chapters 80–81.

Since the publication of *Qumran and Apocalyptic*, the study of AB has made considerable progress. Two of the most important copies of 4QEnastr have been republished in the DJD series, together

[1] F. García Martínez, "Contributions of the Aramaic Enoch Fragments to our Understanding of the Books of Enoch," in *Qumran and Apocalyptic: Studies on the Aramaic Texts from Qumran* (STDJ 9; Leiden: Brill, 1992), 45–96; originally published as "Estudios Qumránicos 1975–1985: Panorama Crítico (I)," *EstBíb* 45 (1987): 127–73; pp. 47–60 of the English version relate to AB.

[2] The debate is neatly summarized by García Martínez, *Qumran and Apocalyptic*, 50–53.

with a substantial monograph dedicated to AB and its cultural roots.[3] While Milik relied on the references to Enochic astronomical compositions in pseudo-Eupolemos and *Jub* 4:17ff in order to claim that a full AB already existed at an early stage, it is clear today that these references cannot be used to prove the actual extent of the early Enochic composition.[4] Instead, attestation for the early existence of AB must be sought from within the textual witnesses themselves.

This is by no means an easy task. The text in AB is not uniform, since a great variance exists between the Aramaic fragments and the Geez text, especially with respect to lunar theory. Furthermore, being twice removed from the original (Aramaic-Greek-Geez),[5] the Geez version is often awkward and muddled—to the extent that its original signification becomes nearly impossible to reconstruct. In several cases it must be assumed that later Ethiopic authors modified the Geez text, requiring an additional consideration of traditional Ethiopic interpretations of the Enochic text. A basic clarification of the nature of the text of AB in its various versions is thus called for as a prerequisite for the present discussion.

Milik has demonstrated the resemblance between the Aramaic fragments from Qumran and the Geez of *1 Enoch* 76–79, 82.[6] Since

[3] E. Tigchelaar and F. García Martínez, "4QAstronomical Enoch[a-b] ar," DJD XXXVI, 95–171; M. Albani, *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch* (WMANT 68; Neukirchen-Vluyn: Neukirchener, 1994).

[4] See García Martínez, *Qumran and Apocalyptic*, 54; M.A. Knibb, "Which Parts of 1 Enoch Were Known to Jubilees? A Note on the Interpretation of Jubilees 4.16–25," in *Reading from Right to Left: Essays on the Hebrew Bible in Honour of David J.A. Clines* (JSOTSup 373; ed. J. Cheryl Exum and H.G.M. Williamson; Sheffield: Academic Press, 2003), 254–62. For the ambiguity of references and quotations in ancient Jewish literature, see recently D. Dimant, "Two 'Scientific' Fictions: The so-called Book of Noah and the Alleged Quotation of Jubilees in CD 16:3–4," in *Studies in the Hebrew Bible, Qumran, and the Septuagint Presented to Eugene Ulrich* (VTSup 101; ed. P.W. Flint et al.; Leiden: Brill, 2006), 230–49.

[5] Despite the views prevalent in earlier research, we concur here with VanderKam's opinion that the Geez version was produced from a Greek translation and that the Ethiopic scribe did not have access to an Aramaic original: see J.C. VanderKam, "The Textual Base for the Ethiopic Translation of 1 Enoch," in his *From Revelation to Canon: Studies in the Hebrew Bible and Second Temple Literature* (JSJSup 62; Leiden: Brill, 2000), 380–95.

[6] See the Aramaic-Geez synopsis (in German translation) in U. Glessmer, "Das astronomische Henochbuch als Studienobjekt," *BN* 36 (1987): 69–129.

the apocalyptic narrative and admonition in 80:1–82:4a are not paralleled in Aramaic, they will not be discussed here. Chapters 72–75, however, which find a partial and rather distant parallel in what Milik called "the Synchronistic Calendar,"[7] require closer examination. In the Geez version, these chapters are arranged in the following order:

> 72 mechanical model for the solar orbit and the length of day and night
>
> 73–74 lunar theory
>
> 75 summary (vv. 1–3); weather and stars (vv. 4–9)

In contrast to this thematic order, two copies of the Aramaic AB—4Q208 and 4Q209—present a lengthy account which amalgamates most of the topics discussed in 72–74 (Geez), although in significantly different form. While the earlier scroll, 4Q208 Enastr[a], contains fragments of this account alone, the later scroll, 4Q209 Enastr[b], also includes passages which closely parallel the text of the present AB contained in chapters 76–82. 4Q209 thus constitutes an important link between 4Q208 and the remainder of AB. What can we say concerning the composition contained in 4Q208 and in (parts of) 4Q209, however? This lengthy composition records a series of fractions describing lunar visibility throughout the days of the year, together with a record of solar and lunar positions expressed by the system of the twelve heavenly gates. Milik considered this composition to establish an alignment of the lunar and solar orbits by inserting a 37th lunation after three years, yielding the following equation:[8]

$$3 \times 354 + 30 = 3 \times 364$$

Since he perceived this equation to constitute the text's primary purpose, he named it the "Synchronistic Calendar." On various grounds, this term now appears inadequate, however. Firstly, the composition is not a calendar at all but an astronomical list, a fact which a comparison with cognate Mesopotamian texts such as EAE

[7] J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976), 274.

[8] Milik, *The Books of Enoch*, 275.

14 makes clear (see below Chapter 4). Secondly, the above-noted equation is self-evidently not the central theme of the composition: the main thrust of the argument is in fact to track lunar visibility throughout the year. As we shall indicate below (3.4), this composition does not cover a triennial cycle at all but merely a single schematic year.

In his recent study, Henryk Drawnel has significantly enhanced our understanding of the purpose of the figures in 4Q208–4Q209. IN calling the composition the "Aramaic AB"—or AAB[9]—he attempts to distinguish the lengthy AAB from the Ethiopic AB, which employs a different method of presentation. Since other copies of the Aramaic AB—4Q210, 4Q211, and parts of 4Q209—attest to the existence of several *Aramaic* chapters virtually identical with the Ethiopic AB, this distinction is also an inadequate solution. How then should we identify this elusive composition?

Judged according to its contents, the composition contained in 4Q208 and parts of 4Q209 is best designated as an "Expanded Model of Lunar Visibility" (EMLV). It is "expanded" because it includes not only the series of fractions measuring lunar visibility but also data on solar and lunar positions (expressed by the system of heavenly gates). The term EMLV will thus be adopted in this volume and used as the standard below. However, despite its inadequacy we shall occasionally retain the old title—"Synchronistic Calendar"—for the sake of clarity.

The Aramaic composition EMLV differs from the remainder of AB in several aspects. Not only does AB separate the sun and moon into different lists but it also employs more abstract calculations, utilizing a concrete model rather than a daily roster. Furthermore, the distinction between aspects of Time and Space—which dominates the Geez AB—is absent from EMLV. Given this circumstance, the background of these two similar yet variant sources demands investigation. Did a text exist at any time which could justifiably be designated as the "original AB"? Furthermore, if such a text did exist, did it more closely resemble the present AB or the longer Aramaic

[9] H. Drawnel, "Moon Computation in the *Aramaic Astronomical Book*," *RQ* 23 (2007): 3–41.

roster? Either the EMLV constituted the original text, later abridged and redacted to produce a version reflected in the present AB—or the analytical treatise reflected by the present AB represents the original, the EMLV being an interpretative expansion of it.

The foremost advocate against the existence of an "original AB" has been Matthew Black. In the introduction to his commentary on *1 Enoch* he writes:

> What we have in Chapters 72–82 are representative 'astronomical' and calendrical excerpts, translated from abridged and adapted Greek excerpts, replacing the tediously long Aramaic calendrical calculations and 'astronomical' speculations … [AB] is manifestly an artificial, originally Greek, versional creation … There never existed in Aramaic a third astronomical 'Book of Enoch.'[10]

The present Chapter will demonstrate that AB existed as a coherent whole rather than a selection of excerpts—and at an early stage. Furthermore, the undeniable identity of some Aramaic fragments with the Geez text of chapters 76–79, 82 proves that this more-or-less coherent order already existed in the Aramaic stage of transmission, before it reached the hands of Greek compilers. The processes of abridgement and simplification were already active in that early stage. In fact, the work of Greek (or rather, Hellenistic) authors is discernible only in 74:10–16. When properly studied, it is clear that the astronomical Aramaic material found in Qumran does not constitute the "mass of Aramaic material" Black believed it to be. While it is true that the textual witnesses of AB has reached us in a garbled state—in both the Geez and Aramaic versions—this does not prove that they were randomly compiled at the outset. The discussion below is designed to identify as accurately as possible the thematically-coherent text of the "original AB."

Regarding the question of the priority of the versions, given that it appears in significantly older manuscripts one is tempted to prefer the Aramaic text over the Ethiopic *a priori*. The rules of textual criticism preclude such a preference, however, due to the fact that the Ethiopic text may reflect an ancient *Vorlage*. While the Ethiopic text

[10] M. Black, *The Book of Enoch or I Enoch: A New English Edition with Commentary and Textual Notes* (SVTP 7; Leiden: Brill, 1985), 10.

undoubtedly includes glosses and possibly even more extensive redaction by Ethiopic scribes, this activity had no effect on the overall message of AB, remaining merely marginal in it.

Milik, the first editor of the Aramaic Enoch fragments, declared the "Synchronistic Calendar" to be the earliest version of AB. His argument was based on the third to early second century B.C.E. dating of 4Q208, a scroll which contains no other material apart from the "Synchronistic Calendar." In addition, Milik drew an outline for the textual development of AB, noting the unreasonably long text that would have been required to accommodate the entire composition. In his view, the pristine version was extremely long, to the extent that it was later systematically abridged.[11] He suggested that the Aramaic scribe did not complete his composition but rather created a précis for it, this text being subsequently reworked by a Greek translator to produce the present text of *1 En* 73:1–74:9. Although Milik's hypothesis initially won general scholarly consent,[12] a second possibility has recently been raised by Stern:

> … it remains unclear to me how, or on the basis of which criteria, these fragments were identified by Milik as belonging to an Aramaic *Enoch*, as opposed to other calendrical texts from Qumran that were not … those from Milik's 4QEnastr corpus are very different from the Ethiopic text … I would not rule out the possibility, therefore, that the so-called *4QEnastr* texts, as well as the other Qumran calendrical texts … are no more than *commentaries* or exegetical *expansions* of the original book of *Enoch*.[13]

This short statement challenged the reigning consensus in the history of research on AB. Since Stern's study does not focus on AB, and only touches on the calendrical texts in passing, his argument was not

[11] Milik, *The Books of Enoch*, 275.

[12] See, for example, J.C. VanderKam, *Enoch and the Growth of an Apocalyptic Tradition* (CBQMS 16; Washington, DC: Catholic Biblical Association, 1984), 81; H.S. Kvanvig, *Roots of Apocalyptic: The Mesopotamian Background of the Enoch Figure and of the Son of Man* (WMANT 61; Neukirchen-Vluyn: Neukirchener, 1988), 58, for chapters 76–82 (but not for chapters 72–75 or the "Synchronistic Calendar"); G.W.E. Nickelsburg and J.C. VanderKam, *1 Enoch: A New Translation* (Philadelphia: Fortress, 2004), 6–7.

[13] S. Stern, *Calendar and Community: A History of the Jewish Calendar 2nd Century B.C.E. – 10th Century C.E.* (Oxford: Oxford University Press, 2001), 6 (original italics).

extensively elaborated. His claim must be evaluated first of all in light of the codicological data on the ancient copies of AB. The earliest copy of AB-related literature is 4Q208 Enastr[a], dated to the early second or late third century B.C.E.[14] This manuscript contains the EMLV alone, with no parts of *1 Enoch* or of AB. Such an early attestation of the EMLV—much earlier than any other copy or version of AB—precludes the view that it is merely the expansion of a shorter original.

The antiquity of the EMLV appears to be so well rooted that it raises questions whether other parts of AB also existed alongside it at such an early period. Tigchelaar and Knibb have recently related to this issue in passing, expressing their opinion that 4Q208 does not constitute a copy of AB but only of the "Synchronistic Calendar," and that, *mutatis mutandis*, the paleographical dating of 4Q208 is no proof for the antiquity of the entire AB.[15] In the view of these two scholars, no evidence exists for the existence of AB in the early second century B.C.E. Tigchelaar goes further in claiming that, since it is even doubtful whether 4Q208 was sufficiently long to contain the entire "Synchronistic Calendar," that scroll could hardly have included the other astronomical passages now present in AB.

In our opinion, the testimony of 4Q209 Enastr[b]—which formed an important part of Milik's argument but is almost completely ignored by Tigchelaar—carries substantial weight. In addition to the EMLV, this latter manuscript also contains close parallels to the Geez text of chapters 76–79, 82. Although, like 4Q208, this scroll contained the lengthy EMLV, the author felt no restraint in inserting other parts of AB into it as well. If such a process was possible in 4Q209, why not also in 4Q208? Furthermore, we shall demonstrate below (3.4) that the EMLV (i.e., Milik's "Synchronistic Calendar") was not as lengthy as Milik surmised. Since the original composition only covered one year rather than three years, its assumed extent would have to be

[14] Milik, *The Books of Enoch*, 273. To the best of my knowledge, this dating has not been contested.

[15] E.J.C. Tigchelaar, "Some Remarks on the Book of the Watchers, the Priests, Enoch and Genesis, and 4Q208," *Henoch* 24 (2002), 145; M.A. Knibb, "Interpreting the Book of Enoch: Reflections on a Recently Published Commentary," *JSJ* 33 (2002), 448; cf. also idem, "Which Parts of 1 Enoch Were Known to Jubilees?"

reasonably included on one scroll, together with other parts of AB. The codicological evidence allows that an early book included the EMLV alongside other parts of what is now AB.

It is nonetheless acknowledged that Stern raised a central insight for the understanding of the textual transmission of AB. Before the (still unattested) Greek and the (extant) Geez versions achieved canonical status, the transmission of the text of AB remained fluid.[16] The lessons we have learned through fifty years of textual criticism of the Hebrew Bible with regard to the flexibility of textual transmission are also applicable to AB.[17] Whatever the nature of the original *Vorlage* of AB in the first centuries after its composition, it circulated in numerous versions, some of which we would designate "copies," others constituting paraphrased versions, reworked texts, or interpretative expansions of the original. For example, the composition on lunar phases preserved in 4Q317 interprets and expands the EMLV. Similarly, some of the earlier Ethiopic astronomical texts may also be considered a reworking of AB. This is also true, to a certain extent, with regard to the lunar texts preserved in 4Q320, 4Q321, and 4Q321a, inasmuch as they seek to solve the original questions raised in AB through the use of an improved method. Stern is therefore correct in demanding a more thorough study of the EMLV with regard to the presumed *Vorlage* of AB.

A further argument related to the present discussion is based on content rather than on codicology. When attempting to fix the priority of the shorter and longer versions of AB, one must consider the type of reasoning employed by each version. The question may be raised, which conceptual framework better fits the original composition—the analytical model of *1 Enoch* 72–74, 78–79 or the lengthier, synthetic presentation of the EMLV? At first sight, this query appears to be a rather subjective one. In light of the specific calendar tradition

[16] Cf. García Martínez, *Qumran and Apocalyptic*, 47–60.

[17] This is a broad topic which cannot be fully examined here. See, for example, S. Talmon, "Aspects of the Textual Transmission of the Bible in Light of Qumran Manuscripts," in *The World of Qumran from Within: Collected Studies* (Jerusalem/Leiden: Magnes/Brill, 1989), 71–116; E. Ulrich, *The Dead Sea Scrolls and the Origins of the Bible* (Grand Rapids: Eerdmans, 1999), 34–120; E.D. Herbert and E. Tov (eds.), *The Bible as Book: The Hebrew Bible and the Judaean Desert Discoveries* (London: British Library, 2002).

discussed here, however, it is more reasonable to suppose that the longer version predated the shorter one. The separation of sun from moon and of passages dealing with Time from those treating spatial aspects constituted an interpretative principle in the composition of AB and of later calendar texts. Some of these later results are apparent in the lunar texts of 4Q317, 4Q320, and 4Q321, where the same conceptual separation is employed, the aspect of Space gradually receding and allowing for discussions of the moon's orbit as expressed only in Time. It is thus plausible to trace the development of AB in one continuous line from the synthetic to the analytic—more specifically, in the direction of abstractionism. In the framework of the present calendar tradition, this development equally entailed a shift from relative observational accuracy to the strengthening of schematic calculations. In other words, not only were spatial aspects of the moon's orbit separated from temporal calculations but they were also gradually discarded altogether.

In light of the above, Stern's statement that the "Synchronistic Calendar" is a kind of rewritten-AB appears unwarranted, given that it counters the mode of development of the calendrical tradition as attested in various Qumran compositions. This long Aramaic treatise preceded the shorter accounts preserved in the rest of AB.

2.2 Lunar Theory in AB

Having clarified some prerequisites regarding AB's textual nature, we may now proceed to a detailed study of the way the astronomical knowledge was formulated and designed in the various versions.[18] Since the textual development of AB constitutes a primary interest of the present study, we shall focus not only on the Aramaic EMLV but also on the way it was reworked. Specific attention will be paid to the passages on lunar theory, where much of the work of redactors, translators, and copyists took place. The distinct pericopae of lunar theory in AB are delimited and discussed below.

[18] The ideas presented here take their point of departure from Albani, *Astronomie und Schöpfungsglaube*, 69–89.

As noted by Albani, lunar theory in AB can be divided into two components: Time and Space. With regard to Time, we are now in a position to estimate how the time-intervals of daytime and night-time lunar visibility were recorded in the Aramaic EMLV in a form which closely resembles the Mesopotamian text EAE 14.[19] One of the elements discussed in the EMLV—albeit a marginal rather than a central issue—is the amount of light in the moon throughout each day of the month. In contrast, other sections of AB—chapters 73–74 and 78–79—place the amounts of light in the moon at the centre of the reader's attention. This is seen from statements such as 73:5b–6 and 78:6 (the latter paralleled in 4Q210 1 iii). The moon's waxing and waning is recorded according to the number of observable "parts" in the moon throughout the month. The moon contains fourteen "parts" —or rather two "halves" each divided into seven parts.[20] At the beginning of the month, the moon is in a completely dark phase, gradually growing to a full moon of fourteen parts. This latter phenomenon occurs on day 14 of a hollow month or day 15 of a full lunar month. The moon then diminishes one part every day until it once again becomes an empty disc. Hollow and full months alternate regularly.

The spatial aspect of the moon's motion is traced according to the system of twelve heavenly gates. It is kept in conjunction with the expression of the sun's position using the same system. In each schematic month, the sun traverses through a certain gate in the east and its parallel in the west: gate 4 in month I, gate 5 in month II, etc. (see FIG. 1.1). Since the moon travels much faster then the sun, in the same schematic month it passes through all the gates of heaven, remaining in each of them for several days. The moon's passage through the gates is described in TABLE 2.1 below. Although the

[19] See Drawnel, "Moon Computation in the *Aramaic Astronomical Book*," and below 4.3.4.

[20] The "parts" are expressed in the Geez AB by the suffix –ʾ*ed* attached to the number of parts. This suffix denotes "hand" but also "fraction, part." This is also the case in Hebrew—as, for example, in Gen 47:24 and Neh 11:1 (*HALOT* 2:388 mng. 7b). For the astronomical usage of *yad* in rabbinic Hebrew, see, for example, *t. Bik.* 2:8 (ed. Zuckermandel, 101); *b. Roš Haš.* 13a; cf. E. Ben-Yehuda, *A Complete Dictionary of Ancient and Modern Hebrew* (Jerusalem and Tel Aviv: Laʿam 1948–1959), 4:1968. For the extraordinary number of 15 parts in 78:7, see below 2.3.4.

figures in the table are based on a late Ethiopic composition, they correspond—except for some minor differences—to the figures in both the Geez and Aramaic AB.[21]

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Gates													Gates
4	2												4
5	2	2											5
6	8	8	4	4									6
5	2	2	2	2	2								5
4	1	1	2	2	1	2							4
3	1	1	1	1	1	1	2						3
2	2	2	2	2	2	2	2	2					2
1	8	7	8	7	8	7	8	7	4	4			1
2	2	2	2	2	2	2	2	2	2	2	2		2
3	1	1	1	1	1	1	1	1	2	2	1	2	3
4	1	1	2	2	1	1	1	1	1	1	1	1	4
5		2	2	2	2	2	2	2	2	2	2	2	5
6			4	4	8	8	8	8	8	7	8	8	6
5					2	2	2	2	2	2	2	2	5
4						1	1	1	1	1	1	1	4
3							1	2	2	2	1	1	3
2								1	2	2	2	2	2
1									4	4	8	7	1
2											2	2	2
3												1	3
4													4
Days	30	29	30	29	30	29	30	29	30	29	30	29	Days

TABLE 2.1: The moon in the heavenly gates throughout the year

The moon remains between 1–8 days in each gate. For example, in month I the moon traverses the central gate 4, close to the spring equinox, only on the first two days of the month. It then moves to gate 5 for two more days, and then to gate 6 for eight more days, etc. Only on the final day (30) of the month does it return to rise with the sun

[21] TABLE 2.1 is based on Neugebauer, "Appendix A" in Black, *The Book of Enoch or 1 Enoch*, 400. For the differences between the Aramaic text and the Ethiopic figures, see Milik, *The Books of Enoch*, 283; P. Dubovský, "Cosmology in 1 Enoch," *Archiv orientální* 68 (2000): 208–11.

through gate 4. Sun and moon thus reach conjunction at the beginning of every month, as illustrated in FIGURE 2.1.

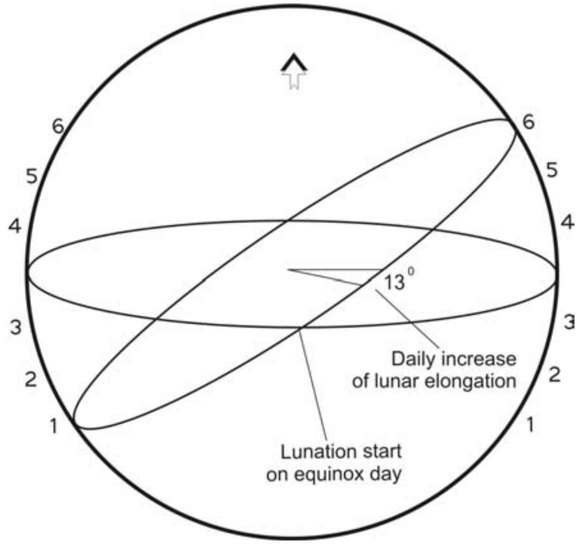

FIGURE 2.1: The path of the moon on the ecliptic and its projection on the heavenly gates[22]

The Enochic authors do not track the path of the moon along its entire course (as, e.g., in Mul.Apin section f). As with the solar model of chapter 72, the spatial model for the moon's orbit accounts for the variation of the moon's position on the horizon. This can be calculated as a projection eastwards or westwards of its position on the ecliptic —and indeed the Enochic system of gates produces a reasonable representation of this data.[23]

Lunar data in the Ethiopic AB are transmitted in two separate treatises, chapters 73–74 and 78–79. Neugebauer noted that the two

[22] The angle of *the* ecliptic in FIG. 2.1 is exaggerated and does not reflect the true angle of 23.50. It is presented in this way in order to emphasise the projection on the horizon.

[23] See *Albani*, *Astronomie und Schöpfungsglaube*, 76.

text units represent alternative treatises on lunar theory.[24] Each of the treatises originally concluded with a section on the stars—75:1–3 and 82:4b–20 respectively—thus yielding an equivalent structure in chapters 72–75 and 78–79, 82. Each treatise devotes specific passages to the spatial and temporal models of the moon's orbit. The first lunar treatise (73–74) presents an elegant construction of two passages only, one describing Time, the other Space. The structure of the second lunar treatise (78–79), however, was distorted during transmission, although it may reasonably be assumed to have originally existed.

The structure of the lunar treatises in AB can be further expanded. The first passage of each treatise is confined to the limits of a lunar month, focusing on the daily accumulation or decrease of lunar light within that month. In this type of lunar passages, no mention is made of the primary spatial model, that of the heavenly gates; the scattered notes on the position of the moon in these passages adopt a different mechanism (see below). In contrast, the second passage of each treatise (or its remains, in the case of the second treatise) focuses more specifically on the lunar *year*, the main interest lying in the path of the moon in the heavenly gates. Finally, the passages on lunar theory are followed by additional short passages which calculate the number of days in the lunar year and the difference which they exhibit from the schematic 364DY.

The structure which emerges can be outlined as follows:

Lunar month—number of illuminated parts—aspects of Time (primarily)

Lunar year—place in the heavenly gates—aspects of location in Space

Lunar year—number of days compared with the 364DY

[24] Neugebauer, "Appendix A," 387. Neugebauer, however, opined that each treatise contained only one chapter of lunar theory—73 and 78 respectively—and the entire text of chapter 74 was a late addition (ibid, 399); cf. P. Sacchi, "The Two Calendars of the Book of Astronomy," in his *Jewish Apocalyptic and its History* (JSPSup 20; trans. W.J. Short; Sheffield: Academic Press, 1990), 130–31. Furthermore, Neugebauer regarded chapter 79 as a remnant from a third treatise. We shall demonstrate below, however, the way in which chapters 73 and 74 fit neatly together without significant overlaps or contradictions. With respect to chapter 79, see below 2.2.5.

Below, we shall discuss the following lunar pericopae in AB as newly delimited: 73; 74:1–9, 17; 74:10–16; 78:1–9; 78:10–14, 17; 78:15–16; 79:3–5.[25] These conform to the division in TABLE 2.2.

	Lunar Treatise I (Chapters 73–74)	**Lunar Treatise II (Chapters 78–79)**
Moon I Amount of light during lunar month	73	78:1–9 78:10–14, 17
Moon II Place in the gates during lunar year	74:1–9, 17	78:15–16 79:3–5
Moon III Length of lunar year compared with 364DY	74:10–16	78:15–16, 79:3–5

TABLE 2.2: Passages of lunar theory in the Ethiopic AB

The suggested division pertains mainly to the Ethiopic AB. In general, the second lunar treatise (chapters 78–79) is presented in the Aramaic fragments according to the same principles as those employed in the Geez version and conforms to the same thematic division. However, no close parallel to the first lunar treatise (chapters 73–74) exists in the Aramaic fragments, the EMLV following a different thematic structure wherein the main theoretical aspects—sun, Moon I, Moon II—are integrated into one treatise.[26] Having clarified the thematic order of AB, it is now possible to relate in detail to the passages dealing with lunar theory.

2.2.1 1 En *73:1–8*

Chapter 73 opens with an introductory statement (vv. 1–3) which seeks to place the subsequent technical data in a comprehensive, non-technical, literary frame (cf. 72:2, 78:1–3). In the literary captions for

[25] The present form of 74:10–16 is the product of a late rewriting, while the passage in its presumably original form was part of AB. 79:1–2, 6 does not contain lunar theory but rather constitutes concluding statements of the second treatise—or possibly of AB in its entirety. On the original order of chapters 78–79, see below 2.2.5.

[26] No trace exists in EMLV of calculations of the Moon III type.

the various paragraphs of AB, each technical model is designated as "law" (*təʾəzāz*, 73:1, cf. Aramaic חושבן).

According to 73:3, when full, the moon's light equals one seventh of the sun's light.[27] The statement "and its days are like the days of the sun" in v. 3 reaffirms the theory noted above that the lunar model was initially intended to function in the framework of an ideal 360-day year, rather than in a 364-day year or the more natural lunar framework of months 29/30 days.[28]

Vv. 4–8 describe the moon's status for the first two days of the month only. The depiction of these days notes two related phenomena:

1. the number of illuminated parts (Geez *ʾəd*, *ʾədaw*) in the moon

2. The moon's distance from the sun, measured by $^{1}/_{14}$ fractions of the ecliptic. This distance-measuring system does not conform to the system of heavenly gates common elsewhere in AB.[29] While the former traces the luminaries on the ecliptic, although without acknowledging the full significance of this circle, the system of heavenly gates only knows the positions of the luminaries on the horizon.

While an original account covering the entire lunar month, of which only these two days survived, is not found in the EMLV, Neugebauer has discovered such a treatment in Ethiopic astronomical texts.[30]

Before proceeding to an analysis of chapter 73, we must note the problems arising in the textual versions with respect to the various

[27] For the origin of this numerical relation, see J.C. VanderKam, "Scripture in the Astronomical Book of Enoch," in *Things Revealed: Studies in Early Jewish and Christian Literature in Honor of Michael E. Stone* (JSJSup 89; ed. E.G. Chazon et al.; Leiden: Brill, 2004), 89–103.

[28] See Albani, *Astronomie und Schöpfungsglaube*, 82 n. 125 (but cf. p. 90) and above 1.3.1.1. Neugebauer, "Appendix A," 397, reverts to the notion of an "average" day, explaining 73:3 as indicating that "the number of 'days' in a lunar calendar is the same as the corresponding number of solar days." This interpretation arises from Neugebauer's—unlikely—view that the term "day" in AB may signify various technical meanings. It is difficult to consider that an advanced awareness of discrete day-lengths, as in Babylonian or Greek astronomy, also pertains in AB, however. Neugebauer himself took the appearance of the notion of an average day to mark the late dating of an Ethiopic astronomical text: *Ethiopic Astronomy and Computus* (Österreichische Akedemie der Wissenschaften, philosophisch-historische Klasse, Sitzungsberichte 347; Vienna: ÖAW, 1979), 18 n. 6.

[29] See Albani, *Astronomie und Schöpfungsglaube*, 88–89.

[30] Neugebauer, "Appendix A," 397–98.

numbers and fractions it contains. As Neugebauer cautions in commenting on vv. 6–8, “translation and notes are therefore only tentative and show not much more than that we are dealing with a description of the moon’s increasing illumination.”

V. 4 opens the account of the lunar month with the first moonrise: “it becomes for you the beginning of the month on the thirtieth day”[31]—i.e., day 30 of the previous month. According to Neugebauer, since this verse considers the previous month to be a hollow one, the 30th day is regarded as day 1 of the present month.[32] This practice is quite common in Mesopotamian astronomy: many astronomical cuneiform texts begin the monthly roster with the number “30” in those cases where the previous month is hollow.[33]

Since the moon rises “with the sun in the gate where the sun emerges” (73:4), an observer would not be able to sight it at the very beginning of its monthly orbit. It is only in the evening, when the moon has gained sufficient elongation from the sun, that the first crescent can be observed. This first visibility lasts for a short period after sunset, officially marking the beginning of the lunar month. Since the day is reckoned from the evening, the “new moon” is celebrated from the evening of last visibility and throughout the following 24 hours.[34] This is stated in verse 7b:

[31] Neugebauer, Uhlig, and Nickelsburg-VanderKam translate *ṣəbāḥ* as “day,” while Knibb prefers the literal sense “morning.” Knibb also prefers the literal sense “the first phase of the moon” rather than “the beginning of the month” for the Geez *rəʾəsa warḫa*.

[32] A. Dillmann, *Das Buch Henoch uebersetzt und erklärt* (Leipzig: F.C.W. Vogel, 1853), 227, construes “the thirtieth day” as referring to a count of days within a schematic month that does not conform precisely to the lunar phenomena. He thus sees in v. 4 the beginning of a lunar month which falls on day 30 of an unspecified schematic-solar month. This interpretation was adopted by Talmon and Ben-Dov in DJD XXI, 34 n. 54 (cf. p. 47), and further applied there in the interpretation of 4Q320. I now retract this interpretation, however, in favour of Neugebauer’s, since the alternative system of month reckoning assumed by Dillmann is not sufficiently attested in AB.

[33] One example among numerous others appears in the astronomical diary for the eighth month in the year 378 B.C.E.: see Sachs and Hunger, ADRTB 1:90–91: “APIN 30 sin IGI 14,30: Month VIII, (the first of which was identical with) the thirtieth (of the preceding month), the moon’s first appearance; sunset to moonset: 14° 30´.”

[34] M.O. Wise, “Second Thoughts on *dwq* and the Synchronistic Calendar,” in *Pursuing the Text: Studies in Honor of Ben Zion Wacholder on the Occasion of his Seventieth Birthday* (JSOTSup 184; ed. J.C. Reeves and J. Kampen; Sheffield:

> During that night, at the beginning of its day (*barəʾəsa ṣebāḥ ziʾahu*), at the beginning of the moon's day (*baqədma ʿəlatu*(!) *lawarḫ*), the moon sets with the sun.[35]

The focus in chapter 73 on the place of the moon in heaven is not expressed by the regular system of "gates" but by an independent method which appears to be familiar with the entire circle of the moon's orbit—i.e., the ecliptic. Vv. 5 and 8 (cf. also 78:13) indicate that the amount of light in the moon is dependent upon its elongation from the sun. Thus the beginning of v. 5 reads: *wamanfaqu rəḫuq*(!) 7-ʾ*əd*, "its half is distant one-seventh part (from the sun?)." Neugebauer interpreted the problematic word *rəḫuq* as a *terminus technicus* for elongation, based on a parallel in Ethiopic astronomical manuscripts; his opinion has been accepted by Uhlig, Albani, and VanderKam.[36] Other scholars have rejected this meaning, either on the basis of manuscripts which do not read this word at all, or due to textual emendations.[37] V. 8 equally expresses interest in the moon's elongation when stating that, "it emerges and recedes from the rising of the sun" (*wayəwaḍḍəʾ wayəṣ*(!)*annən ʾəmśərāqa ḍaḥay*).

The main focus of v. 5, as in the rest of the chapter, lies on the amount of light in the moon. On the first day, this is described as "without light, excepting its seventh part of a fourteenth part (i.e., $^1/_{98}$) of the light (of the sun)." This strange number seems to signify that on

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Academic Press, 1994), 101, concludes that according to the reckoning of AB the lunar month begins with conjunction rather than with first visibility. However, he does not bring sufficient support for this contention. In our opinion, AB rather attests to first visibility as constituting the beginning of a month. See also Stern, *Calendar and Community*, 139–43, who points out that the practice of fixing the new moon at first visibility was prevalent during the tannaitic period, while a conjunction New Moon (מולד) based on calculations was only enacted in the late talmudic period.

[35] More freely Neugebauer: "And in this night, at the beginning of the (lunar) day, which is the first day of the month, the moon sets with the sun." As Neugebauer notes, the phrase "with the sun" is only approximately accurate, since on that evening the moon sets around fifty minutes after the sun. Possibly, too, the phrase "with the sun" refers not to the timing but to the proximity of the moon to the sun at the very beginning of the month.

[36] Albani, *Astronomie und Schöpfungsglaube*, 88; Nickelsburg and VanderKam, *1 Enoch*, 100.

[37] D. Olson, *Enoch: A New Translation* (North Richland Hills, Texas: BIBAL, 2004), 150ff, prefers the reading of ms Tana 9, where the word *rəḫuq* does not appear. Knibb suggests that a confusion of the roots *rḫq* "distance" and *śrq* "rise" has occurred here.

the first day of the month the moon is illumined one part out of the total capacity of fourteen parts of light. The full light of the moon equals one-seventh of that of the sun, hence the fraction $^{1}/_{98} = ^{1}/_{14} \times ^{1}/_{7}$. A similar fraction ($^{1}/_{7} \times ^{1}/_{7} \times ^{1}/_{2}$) also appears in v. 6, although the reading is less certain there due to multiple variant readings.

V. 7 repeats the description of the first day of the month, despite the fact that vv. 5–6 have already described that day at some length.[38] This is apparent from the phrase "it sets with the sun, and when the sun rises it rises with it"—a statement which is only valid at the very beginning of the month. The amount of light in the moon is given here as "a half part of light"—i.e., $^{1}/_{14}$ of its total illumination, comparable to v. 5. Although the same proportion is conveyed at the end of v. 7, the author now counts the *dark* parts that are left in the moon: "the moon … is dark that night six seventh parts and its half" (VanderKam's translation). The method of counting both the dark and light parts goes back to the Aramaic EMLV (i.e., the "Synchronistic Calendar")—e.g., 4Q209 7 iii 3–4—and continues in *1 Enoch* and 4Q503. However, the numbers at the end of vv. 6–8 are once again highly problematic and it is difficult to verify whether they correspond to the measure of $^{1}/_{14}$ parts mentioned earlier in the passage.

Excursus: The Question of the "Additional" Half-Part

The Ethiopic manuscripts display highly variegated readings for the numbers at the end of vv. 6–8, thus obfuscating the meaning of the passage. While it is clear that the moon waxes by one part daily until it reaches fourteen parts of light, this framework breaks down in the versions of *1 Enoch*, as well as, somewhat surprisingly, in several later compositions from Qumran.

The problem arises in v. 7, where most group II manuscripts report that the moon is dark "a seventh (and) a seventh part and a half"—as in ms Rylands 23, the base text of Knibb's edition. This seems to be an erroneous reading, however, since it repeats 6b (Neugebauer, Uhlig). VanderKam prefers reading "six seventh parts and its half"—i.e., on day 1, the illuminated part covers $^{1}/_{14}$ of the moon, with the dark part measuring $^{6}/_{7} + ^{1}/_{14}$ ($= ^{13}/_{14}$) of the moon's surface. Alternatively, one may adopt the reading in ms Tana 9, where the word for "half" appears without the copula, implying that it belongs to the beginning of v. 8 rather than to the end of v. 7. In this

[38] Dillmann, *Das Buch Henoch*, 228.

case, 7b signifies that on day 1 the moon is lit with $^1/_{14}$ part and that 6 + 7 (= 13) parts of its surface remain dark.[39]

Other commentators read 7b differently. Knibb, following Charles and Martin, understands that the moon is dark "6 and 7 parts and a half."[40] This reading would mean that in day 1 the moon accumulated only one half of a fourteenth part of light—i.e., $^1/_{28}$ of its surface—leaving 13.5 dark parts to be filled.[41] The two versions differ regarding the question of whether on day 1 the moon has accumulated one part of $^1/_{14}$ or only a half of that part. Although the latter reading is most probably secondary, the apparently trivial disagreement between the two readings carries considerable significance for understanding the moon's illumination in a full month of 30 days.

As a rule, the models in AB operate under a framework of fourteen parts of light in the moon. This is true throughout AB, apart from one implicit exception in 78:7 (see below). In maintaining this number, AB departs from the accepted norm of such documents as EAE 14 which count fifteen phases for the duration of the moon's illumination. The number 14 was probably preferred in AB because of its author's Jewish septenary ideology. Its application to lunar theory raised problems, however, when accounting for a full month of 30 days, where the full moon must be reached on day fifteen of the month. When only fourteen phases of light are available, accumulated daily, this seems impossible. The schematic mode of thought in AB does not usually consider this a serious problem. The issue was raised, however, by secondary transmitters, who devised the idea of an additional half-part, measuring $^1/_{28}$ of the moon's illuminated surface. The place of this half-part, according to the versions in 73:7–8, lay in day 1 of a full lunar month. On such a month, the moon would reach $^1/_{14}$ of its light only on day 2 of the month.

A similar solution was adopted, possibly by a secondary hand, in the astronomical composition contained in 4Q317 Phases of the Moon.[42] Here, an interlinear phrase indicating that the moon was revealed or covered with fourteen and a half parts was occasionally inserted above the line in the description of the full or dark moon (e.g., 4Q317 1+1a ii 28; frg. 2 line 27a). As in *1 Enoch* 73, this additional half-part was not required by the first author but inserted *post factum*. It should be noted that the additional half-part

[39] Olson, *Enoch*, 152–53.

[40] M.A. Knibb, *The Ethiopic Book of Enoch: A New Edition in the Light of the Aramaic Dead Sea Fragments* (Oxford: Clarendon, 1978), 2:172; F. Martin, *Le livre d'Hénoch: Traduit sur le texte éthiopien* (Paris: Letouzey et Ané, 1906), 171.

[41] Cf. R.H. Charles, *The Book of Enoch or 1 Enoch* (Oxford: Clarendon, 1912), 158; Dillmann, *Das Buch Henoch*, 228–29.

[42] This document was first mentioned and partly published by Milik, *The Books of Enoch*, 68–69. The fullest presentation to date is that of M. Abegg in *DSSR* 4, 58–71.

appears here not only at the beginning of the month but also at its mid-point, as it approaches full moon.

Based on the secondary readings in *1 En* 73:7, Francis Schmidt has recently suggested that the additional half-part also existed in the liturgical scroll 4Q503.[43] Schmidt notes the rather curious fact that the number of parts of light for each day recorded in 4Q503 equals one unit less than the ordinal number of that day in the month. Thus, for instance, five "lots" of light are counted on day 6. According to Schmidt, this discrepancy can be explained by the fact that in a full month the moon gains only one half-part on day 1, reaching $^{1}/_{14}$ of its light only on day 2.[44] While this interpretation is plausible it is not necessary, since no description for the first day of the month is extant in 4Q503. It is equally possible that the author of 4Q503 began counting the month on the day of conjunction, with zero parts being lit on day 1—as earlier research suggested.

We thus conclude that the primary versions of AB consistently refer to fourteen parts of light accumulating or decreasing daily, the only exception being the mention of fifteen parts in 78:7. The additional half-part is the result of secondary readings in AB and of corrections in 4Q317. No sufficient evidence exists that this figure also appeared in 4Q503.

V. 8 finally arrives at a description of the moon on day 2 of the month, on which it is first seen during the day. The amount of light in the moon is now "a seventh part exactly"—twice as much as on the previous day. The moon now recedes from the sun, having earlier been in conjunction with it. The figures at the end of v. 8—"six seventh parts" (Nickelsburg-VanderKam)—cannot be construed as the size of the dark part (*pace* Olson), since the word "dark" does not appear in this verse. Rather, they describe the moon's brightness "in the rest of its day"—a common element in the EMLV.[45] This component in 73:8 is described by Drawnel as a "fragment of the calculation of the moon during the day"—i.e., it measures the moon's period of invisibility rather than the size of the lit and dark parts it contains.[46]

[43] F. Schmidt, "Le calendrier liturgique des *Prières quotidiens* (4Q503). En Annexe: L'apport du verso (4Q512) à l'édition de 4Q503," in *Le Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère* (JSJSup112; ed. C. Grappe and J.C. Ingelaere; Leiden: Brill, 2006), 55–87. On 4Q503, see in detail below 3.5.1.

[44] Schmidt, "Le calendrier liturgique," 64–66.

[45] See, for example, 4Q209 7 iii 4: בשאר יממא דן.

[46] Drawnel, "Moon Computation in the *Aramaic Astronomical Book*," n. 4.

Generations of scribes struggled with the numerous counts employed in vv. 5–8, attempting to adjust them in order to yield an intelligible reading. The same problem appears elsewhere in the versions of chapter 78, and thus seems to have constituted a constant predicament for the tradents of the Enochic astronomical discipline. As the focus of AB shifted from measuring the length of lunar visibility (as in EMLV) to measuring the amount of light in the moon, some of the numerical data were possibly also modified and variously manipulated.

In summary, the pericope *1 En* 73:4–8 primarily records the number of illuminated parts in the moon, presenting them in connection with the moon's elongation from the sun. Although the paragraph originally covered the entire lunation, its transmission was badly distorted. The sequence of days seems to have been interrupted after the description of day 2 in v. 8. In addition, the description of day 1 in vv. 5–6 and 7 is rather repetitive and raises several problems. The original pericope generally follows the line of the EMLV, with two main differences: 1) the heavenly gates are not mentioned, and 2) prominent place is given to measuring the amount of light in the moon.

2.2.2 1 Enoch *74*

2.2.2.1 *Delimitation and Internal Structure*

Chapter 74 opens with the introduction of "another course and law" to that presented in chapter 73. V. 2 designates Uriel as the source of this information. The structure of the chapter is as follows:

Vv. 3–4: General: the progress of the moon with regard to the amount of light and the heavenly gates

Vv. 5–8: Detail: the moon's status (amount of light + heavenly gates) in two months of the year

Vv. 9, 17: General statements regarding the moon's path

Vv. 10–16: A comparative count of the days in the lunar year and in the schematic year; construction of various year-cycles in order to reconcile the different counts.

While vv. 5–8 span the two equinoctial months alone,[47] the general statements in vv. 3–4, 9 relate to the entire year. This is evident from v. 4: “in certain months … and in certain months” (both nominal forms in the plural), as well as implicit in the concluding statement of v. 9: “In this way I saw their positions, as the moon rises and the sun sets during those days.”[48] Neugebauer explains this discrepancy by assuming that the two months described in 74:5–8 are merely remnants of a longer discussion, as is the case in chapter 73.[49] Evidence for a longer, “original” text once again appears in Ethiopic texts, which attest to the data produced in TABLE 2.1, where the course of the moon is described along the entire year. Alternatively, it may be suggested that in 74:5–8 the equinoctial months were consciously chosen as a model for the entire year. This view, proposed by Olson, is supported by the use of a similar method in the Mesopotamian lunar text EAE 14 Tables A, B.[50]

Whoever was responsible for the shortened version of this chapter—whether by omission or by deliberate abridgement, and whether in Geez, Greek, or a pristine Aramaic *Vorlage*—left the programmatic statements untouched, altering only the technical data in between them. Taking chapters 73–74 together, we may therefore claim that 73:1–8 constitutes an abridged description of the lunar month, with 74:1–9 serving as an abridged description of the lunar year. Combined with the calculations of 74:10–16 (in their original form),[51] the three passages form a short yet comprehensive treatise on the lunar orbit.

The statement in v. 9 undoubtedly belongs with the previous verses, since its content is linked to v. 3: “it completes all its light in the east and in the west.” The question remains whether v. 9 should be also read with the text that follows it. The answer appears to be in the

[47] Thus rightly Olson, *Enoch*, 152.

[48] As translated by VanderKam. Other commentators read this verse in the plural, as for example, Knibb: “how the moons rose and the sun set in those days.”

[49] Neugebauer, “Appendix A,” 400.

[50] Olson, *Enoch*, 152. For EAE 14, see F.N.H. Al-Rawi and A. George, “Enūma Anu Enlil XIV and Other Early Astronomical Tablets,” *AfO* 38–39 (1991/1992), 55, 67–68. These authors demonstrate how the solstitial month may also serve as a model for lunar theory.

[51] The pericope 74:10–16 is discussed in detail below 3.3.

negative, since the numerical calculations in vv. 10ff clearly do not continue the subject matter of the earlier verse. According to the classification presented above, 74:10–16—like 78:15–16 and 79:3–5—belongs to the "Moon III" category. It is therefore generally accepted that v. 10 opens a new textual unit.[52] According to Albani, this unit only spans vv. 10–16, v. 17 forming a continuation of the earlier unit 73:1–9.[53] The unit in vv. 10–16 interrupts the rhetorical sequence of vv. 9 and 17. The two verses are verbally linked by the term *manābərt*, "positions." Moreover, they display a smooth thematic continuity: The description in vv. 1–9 of the path of the moon in the gates, from which the sun rises and sets throughout the year, continues in v. 17 with a programmatic statement regarding the same phenomenon. The author of that verse—and concomitantly also of 74:1–9 (probably of the entire treatise in chapters 73–74)—apparently sought to explain the solar and lunar orbits on the basis of schematic 30-day months. In his view, this was the only way to reach the circumstance in which "the year is correctly completed" (v. 17). Subsequently, the short passage 74:10–16 sought to align this ideal scheme with the 354-day lunar year.

2.2.2.2 *Comments on* 1 En *74:1–9*

This section discusses the content of vv. 3 onwards. V. 3 maintains the general principle that the moon grows and diminishes from day to day in parts of $^1/_7$. Despite this general principle, chapter 74 makes no mention at all of discrete parts of light—neither in v. 3 nor in any other verse. The moon's light is rather traced according to the key points of complete obscurity and complete light (v. 3: *yəfaṣṣəm kʷellu ṣəlmato/bərhāno*)—i.e., the dark and full moon.[54] This conforms to the

[52] Martin, *Le livre d'Hénoch*, 172; Neugebauer, "Appendix A," 400; Uhlig, *Das äthiopische Henochbuch* (JSHRZ V, 6; Gütersloh: Gütersloher, 1984), 649; Albani, *Astronomie und Schöpfungsglaube*, 31, 74.

[53] Albani, *Astronomie und Schöpfungsglaube*, 74. This is implied also by Neugebauer, *Ethiopic Astronomy and Computus*, 231, although not made clear in his commentary.

[54] Nickelsburg-VanderKam prefer a *lectio brevior* which mentions only full light, following several important group I mss (cf. Uhlig's note c). This short reading, however, could have been caused by homoioteleuton, and the fact that it is not supported by the important ms Tana 9 undermines its credence.

distinction suggested above: chapter 73 counts the parts of light and ignores the heavenly gates, while chapter 74 notes the heavenly gates and ignores the parts of light.

At the end of verse 3, the place of the key points in the moon's orbit is fixed "in the east and in the west." Several manuscripts add further details, assigning full darkness to the west and full light to the east. Olson appraises this reading as "perfectly accurate."[55] Full moon is indeed first observed in the east, in opposition to the setting sun. If so, the almost-dark moon is associated in 74:3 with the west, possibly because on the second part of the month the moon's setting during daytime is gradually delayed, until at the end of the month it sets close to sunset. However, *pace* Olson, a more evident place to watch for the nearly dark moon would be in the east, just before sunrise on its last visibility—designated KUR "(sun)rise" in the standard Mesopotamian terminology.[56] The obscure wording of 74:3 does not therefore permit a conclusive interpretation.

In 74:4, the preferred reading follows Neugebauer: "In certain months (the moon) changes (the location of) its settings (with the sun, but) in certain months it goes its own individual way." This is an important statement by the Enochic author, who acknowledges that his model is not universally valid. While the moon normally completes a full round in the gates and returns in time to set in the same gate with the sun at the end of the month, the author occasionally "allows" the moon to end its monthly orbit in an adjacent gate.[57]

The mss that do represent the longer version of 74:3 disagree with regard to the order of presentation of full light and full darkness. While ms Tana 9, among other mss, presents darkness first (accepted by Isaac and Olson), all other group I mss present light first (supported by Charles, Martin). The reading in Tana 9 was interpreted by Stephane Saulnier as signifying a divergent reckoning which placed the beginning of the month at full moon, with the waning moon ("dark") standing at the first part of the month: S. Saulnier, "The Date of the Last Supper and Calendrical Variations in Second Temple Judaism" (PhD Diss., Canterbury, 2006), 18–22; I am grateful to Dr. Saulnier for providing me with a copy of his research. It would nonetheless appear that the variant is no more than a literary device, since 74:3 clearly does not intend to make any substantial claim regarding the details of calendar reckoning but rather constitutes a statement on the general conduct of the moon.

[55] Olson, *Enoch*, 152.

[56] Sachs and Hunger, ADRTB, 1:20.

[57] Neugebauer, "Appendix A," 398–99; cf. E.S. Hartum, "Enoch," in *Ḥezyonot* 1 (*Ha-Sepharim Ha-Hitsonim*; Tel Aviv: Yavneh, 1967), 85.

According to v. 5, sun and moon traverse together through the middle gates—numbers 3 and 4—in the equinoctial months (cf. 75:2, 82:6). Although vv. 6–8 provide more details on the course of the moon in these months, the numbers contained in them are not entirely clear. The compiler of this text neglects to mention the less important gates 2–3 and 5, focusing instead on gates 1, 4, and 6. The days which "belong" to the insignificant gates are absorbed into the days assigned to the more important gates. In addition, the shorter time units of 1–2 days are absorbed into longer units of 7–8 days.[58]

The ideal path of the moon in the equinoctial month is excerpted from TABLE 2.1 as follows:

Gate	4	5	6	5	4	3	2	1	2	3	4
Number of days	2	2	8	2	1	1	2	8	2	1	1

According to this ideal plan, month I lasts thirty days, during which the moon traverses the outermost gates 1 and 6 over eight days each. The data given in 74:6–8 do not correspond to this scheme in any way, however. Neugebauer endeavoured to reconcile these verses by excising some of the figures as late interpolations and creatively interpreting the remainder. Olson suggested, more convincingly, that v. 6 constitutes an attempt to provide a general principle for the moon's orbit, unrelated to any specific month, while vv. 7–8 return to a detailed description of month I. It should be acknowledged that the "abridgement" of AB involved a combination of general principles with specific data pertaining to one month or another. The resulting text is often too ambiguous to yield any coherent picture.

[58] This also seems to be the case in *2 En* 13:3, where the moon's path in the gates is primarily based on multiples of seven; see Z. Ben-Shahar, "The Calendar of the Judaean Desert Sect" (PhD Diss., Tel Aviv University, 1975), 145ff; Neugebauer, *Ethiopic Astronomy and Computus*, 157; C. Böttrich, *Das Slavische Henochbuch* (JSHRZ V, 7; Gütersloh: Gütersloher, 1995), 865.

2.2.3 *A First Treatise on Lunar Theory: 73:1–74:17 and its Relation to the EMLV*

Although the first lunar treatise in the Ethiopic AB is clearly based on the EMLV, few unequivocal parallels can be identified. In the following section we shall compare the thematic contents of both sources in order to provide a more reliable basis for understanding the tradition-history of the material.

Drawnel's recent essay reinterprets the Aramaic text of the EMLV and improves on the earlier interpretation given to it by Milik and Neugebauer.[59] Drawnel produces useful tables, demonstrating the series of fractions in EMLV and its similarity to the Mesopotamian source EAE 14. Since we accept his interpretation, the analysis of the Aramaic and Geez versions is conducted below in its light.[60] It should be noted, however, that side by side with the measurements of lunar visibility, the Aramaic roster also occasionally accounts for several other phenomena:

> a) the number of lit or dark parts in the moon (Drawnel's column F)
>
> b) the place of the moon in the heavenly gates (Drawnel's column C)

In addition, three categories appear outside the fixed patterns of waxing and waning:

> c) The place of the sun in the gates at the beginning of every schematic month, as in 4Q209 7 iii 1–2 (DJD XXXVI, 147):

בליליא דן אשל̊[מת] שמשא למהך כל חרתיה די בתרעא קדמיא ומשרה למתב
למתה ולמפק בחרתיה

> During this night the sun compl[etes] the passage (across) all the sections of the first gate, and it begins again to go and come out through its sections

Note that item c resembles the usage in *1 En* 72:27.

[59] Drawnel, "Moon Computation in the *Aramaic Astronomical Book*."

[60] I hope to present some modifications of his view in a separate publication. See also below 4.3.4.

> d) The place of the moon with the sun on the day of conjunction, as in 4Q209 6 9 (DJD XXXVI, 144):
>
> ולקיח כל שאר נהורה ונפק גלגלה ריקן מן כ̊ל נ̇הור מט̇מר עם ש]משא[
>
> And all the rest of its light is removed, and its disk emerges, devoid of all light, hidden by? [the] s[un

Item d resembles the usage in *1 En* 73:5 and 78:14.

> e) The amount of light in the moon with respect to the sun (possibly represented in 4Q208 10a 9).

Item e resembles the calculations in *1 En* 73:6–7.[61]

A comparison between the EMLV and the treatise on lunar theory in *1 Enoch* 73–74 indicates that the most pronounced difference lies in the marginalization of the time-periods of lunar visibility in the latter source. It is clear that items a–e are paid prominent attention. Notably, these are all elements which are *not* related to actual time measurements of lunar visibility: chapters 73–74 focus on Space—solar and lunar positions expressed by the twelve heavenly gates—and the amount of light in the moon.

Furthermore, the EMLV and *1 Enoch* 73–74 employ a different order of discussion for various astronomical phenomena. The following TABLE compares their respective contents. It proves that the information taken from the EMLV was assigned to two separate types of text units. While chapter 73 counts the parts of light and ignores the heavenly gates, chapter 74 concentrates on the gates and neglects the count of parts of light. The two types are combined together in a short yet comprehensive treatise of lunar theory, which concludes with the programmatic statements of 74:9, 17.

[61] See the comment by Tigchelaar and García Martínez in DJD XXXVI, 114.

Expanded Model of Lunar Visibility (EMLV)	**Chapter 73**	**Chapter 74**
1 (Primary interest): periods of lunar visibility	8?	
2. Number of lit/dark parts in moon	v. 5, 7–8	
3. Daily increment in amount of light	v. 6	
4. Place of moon "with" the sun (no gates mentioned)	vv. 4,[62] 5, 7–8	
5. Place of the moon in heavenly gates		vv. 6–8
6. Place of sun and moon in heavenly gates		vv. 5, 6, 8
		Count of days in various year lengths (74:10–16)

Table 2.3: Comparison of themes: EMLV and 1 Enoch *73–74*

On the basis of the above analysis, we propose the following outline of the composition process. A writer or a group of writers wrote a reworked version of the EMLV. In this version, the time-periods of lunar visibility were almost entirely neglected, while other elements of that composition were assigned to two separate text units. The products of the reworking are not preserved in Aramaic, although the reworking was undoubtedly undertaken in that language. Proof for this assertion lies in the second lunar treatise of AB (chapters 78–79), fragments of which were discovered at Qumran in Aramaic, as discussed below.

A final question remains to be asked regarding whether the programmatic statements and summaries extant in the Ethiopic AB existed in the earlier Aramaic composition or whether the latter only contained technical details. Cases in point would be the declarations on the "harmony of the world" in 74:12, 17 or the calculations in 74:10–16, which are not characteristic of the technical style prevalent in the EMLV. Generally speaking, the fact that such statements were not preserved in 4Q208 and 4Q209 does not rule out the possibility

[62] *1 En* 73:4 does in fact mention gates when describing the conjunction: "(…) with the sun in the gate where the sun emerges." However, no gate number is mentioned here and no sign of any gate calculations appears.

that they existed in the original composition—and that in incorporating 74:12, 17 the Ethiopic AB reflects an older tradition.

2.2.4 *The Second Lunar Treatise, Part I:* 1 En *78:1–9*

Chapters 78–79 contain a second treatise on lunar theory. In many ways, this treatise duplicates the earlier one, although its delimitation and internal structure are not as well preserved.

The text unit 78:1–9 opens with a lengthy introductory note in vv. 1–5, giving the names of sun and moon and describing the amount of light in them and the manner in which they traverse the gates.[63] V. 5 is the sole place in this unit where the heavenly gates are mentioned—although non-specifically and independent of any numerical or geometrical scheme.

The technical data on the moon begins in v. 6 with a depiction of the lunar month. Employing the categories presented above, we note that 78:6–9 primarily discusses the number of lit parts in the moon as a function of the day in the month.[64] Spatial aspects—whether with respect to the heavenly gates or to the distance from the sun—are completely absent.

V. 6 first indicates the amount of light in the moon at the beginning of the month—one half of a seventh, i.e., $^{1}/_{14}$—and then moves directly to full moon on day 14. While the waxing half of the month is rather abruptly skipped, the waning part is recounted in great detail in the lengthy v. 8. Immediately following the recording of the full moon on day 14 in v. 6, the text once again marks the full moon (v. 7)—this time, however, on day 15 of the month! What is the reason for this inconsistency? And why is the first part of the month skipped?

[63] Based on the interest of these verses in the sun, it may be suggested that they formed the structural equivalent to chapter 72 in the second treatise, which otherwise does not contain a unit on the that luminary (see below 2.4).

[64] That the amount of light is discussed rather than the periods of visibility is proven by the use of the verb *ḥaṣaṣa* “wane, decrease” in 78:8, probably an equivalent of the Aramaic root בצר.

The above difficulties must be examined in light of the parallel text 4Q210 1 iii 3–5:[65]

3 אנ]י֯ר֯ ב֯שמיא לאת֯ח֯[זיא

4 משל]מין בכל ◦ ^יום^ עד יום ארבעת עשר ומשׂ[למין

5]חמשת עשר ומשלמין בה כל נהור֯ה

3 … shi]ned in the sky to be se[en

4[… compl]ete (pl.) each {day} until the fourteenth day, and co[mplete (?)

5 …] fifteen and (they?) complete all its light in it

Line 3 probably parallels the description of first visibility at the beginning of 78:6; it was thus reconstructed in Milik's edition and in *DSSR* 4.[66] This reconstruction remains plausible, despite the fact that the parallel is restricted to one word, the passive form לאת֯ח֯[זיא in Aramaic, *yāstarʾəy* in Geez (78:6).[67] Instead of the Geez "it is visible in the sky," the Aramaic gives a slightly longer reading: "it sh]ined in the sky to be se[en (on earth?)." Since line 4 mentions day number 14 and line 5 mentions the number 15, the Aramaic text of 4Q210 1 iii appears to maintain the same order as in 78:6–7, skipping directly from day 1 to day 14 and subsequently to day 15. The Geez text is thus faithful to the Aramaic original with respect to the order of days. We must now ask what reason the (Aramaic) author possessed for omitting days 2–13. The answer would seem to lie in the fact that the Aramaic text of 4Q210 itself constitutes an abridged version of a longer source. The close parallel in Aramaic to the second lunar

[65] Milik, *The Books of Enoch*, 292. The readings proposed here differ slightly from those of Milik, based on a fresh examination of the plates. Milik's reconstructions for lines 4–5, followed in *DSSR* 4, 540–41, raise several problems, primarily with regard to the repetition of the phrases ומשלמין בכל יום ויום and ומשלמין בה כל נהורה. We have therefore employed minimal reconstructions here.

[66] Milik, *The Books of Enoch*, 292; revised edition by E. Cook in *DSSR* 4, 540–41; K. Beyer, *Die aramäischen Texte vom Toten Meer* (Göttingen: Vandenhoeck & Ruprecht, 1984), 256.

[67] Strictly speaking, the Aramaic form is an infinitive while the Geez form is an indicative imperfect. The full word לאתחזיא is preserved with regard to the moon earlier in the same scroll (4Q210 1 ii 18). Curiously, the contents of 4Q210 1 iii 3 resemble the literary prologue to the calendrical text 4Q320 1 i 1–2, with the Hebrew verbs להראותה and לאירה.

treatise of *1 Enoch* 78–79 strongly suggests that abridged versions—based on the distinction between the count of parts of light and the tracing of the heavenly gates—already existed in Aramaic at an early stage of AB's transmission.

As Black has pointed out, the Aramaic text of lines 4–5 is slightly longer than the Geez.[68] In the Aramaic text, the descriptions of days 14 and 15 seem to follow the same wording, while in the Geez version the two days are described differently, the note on day 14 being much shorter in Geez than in Aramaic. Furthermore, the contradiction pointed above between 78:6 and 78:7 with regard to the date of the full moon—whether day 14 or 15—already existed in the older version. This contradiction was smoothed over in a later edition, presently reflected in the Geez version.

In order to account for a full moon on day 15, the author was compelled to add an additional part of light, number fifteen. This represents a significant change with regard to the earlier sources, both the EMLV and the first lunar treatise in chapters 73–74 which only know fourteen parts of light. Furthermore, the notion of fourteen parts is immediately raised again at the end of v. 7, in both Aramaic and Geez, in what appears to be a glaring discrepancy with respect to the beginning of the verse. Thus, while 7a explicitly mentions fifteen parts of light, 7b declares: "the moon grows by (units of) one-half of a seventh part." In Aramaic it is stated (line 6):]ו̊דבר ירחיא בפלגי שביעין "and it accomplishes (lit. guides) (its) phases by halves of sevenths" (Milik) or "und er (Uriel?; JBD) führt die Monate in Vierzehnteln" (Beyer).[69] Despite the fact that he has just made use of a different division of the moon's light, the author thus insists on parts of $^{1}/_{14}$, apparently as a result of the need to confront an inherent tension in the

[68] Black, *The Book of Enoch*, 417. Black cites a reading in "Enastr^{b} 1 iii.5" which, however, is not found in the official edition of that scroll in DJD XXXVI.

[69] Since the singular verb דבר is incongruent with the plural noun ירחיא, scholars have been compelled to "manipulate" the translation. Black suggested interpreting the beginning of the sentence as a nominal construct: "And the course of the moon's phases is by halves of sevenths." The meaning "lunar phases" which Milik and Black assigned to the noun ירחיא (lit. "moons") is problematic (cf. Beyer, *Aramäische Texte*, 256, 600). Milik's translation is based on the text in 4Q210 1 ii 18, but this passage is also quite fragmentary (Milik, *Books of Enoch*, 288–90). Overall, Beyer's translation seems preferable.

month’s structure. While the lunar scheme in AB is purely septenary, it must also account for full months, where fourteen phases of the moon are insufficient. A similar problem faced other Enochic authors, leading them to speak explicitly of an additional half-part ($^{1}/_{28}$) (see *Excursus* above 2.2.1). Generally speaking, the Enochic authors were reluctant to admit that they adopted a different mechanism than the traditional fourteen-part apparatus.[70]

Black and Olson have demonstrated that the proper reading of v. 8 should run: “on the first day the moon decreases by one part *from* fourteen parts.”[71] This is clear from the Aramaic text of such statements as 4Q210 1 iii 8: וביומא רב]ע֯יא חד מן חד עׄשׄ]יריא “And on the fou]rth [day] one of ele[ven (parts).” This reading counters the prevalent interpretation of the verse, which renders “on the first day it decreases *to* fourteen parts of its light, on the next day it recedes *to* thirteen parts” etc. (trans. VanderKam; italics added).[72] According to the preferred reading, the moon has no more than fourteen parts, as usual in AB, leaving 78:7a as an exception.

Having established this understanding of 78:8 we must now ask again why full details are only given for the waning part of the month. Dillmann explains that since the waxing moon was treated previously in chapters 73–74, no need existed for its repetition.[73] However, no earlier verse described the waxing of the moon in the same detail in which the waning is recounted in 78:8. We must therefore conclude (again) that chapter 78, even in the Aramaic fragments, constituted an abridged version of a longer text which depicted both waning and waxing.

The last verse in the text unit 78:1–9 concludes all of the above data when relating to the alternation of hollow and full months: “During certain months the moon has 29 days and once 28.” As Neugebauer explains: “Verse 9 offers the possibility that a ‘month’

[70] VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*, 100 n. 73, suggested that fifteen parts of light were the norm not only in 78:7 but throughout AB. Although this method is similar to attestations of early Mesopotamian lunar theory such as EAE 14, apart from 78:7a there is no conclusive proof in AB of the use of fifteen parts. On the other hand, the number of fourteen parts occurs repeatedly.

[71] Black, *The Book of Enoch*, 417; Olson, *Enoch*, 164–65.

[72] This reading is also adopted by Charles, Knibb, Neugebauer, and Uhlig.

[73] Dillmann, *Das Buch Henoch*, 241.

may contain 29 or 28 days (*of visibility*), being either full or hollow" (italics added).[74] *Contra* Charles, v. 9 does not relate to a 28-day month, and no hint of the Callippic cycle is evident.[75] No need exists to assume that the verse deviates from the scheme so fervently propagated in the previous chapters—all the more so since the presence of the Callippic cycle in *1 Enoch* would raise a series of additional problems.

In summary, the text unit 78:1–9 traces the number of lit and dark parts in the moon over the course of one month. The problem of the count of lit parts in a full lunar month is raised in 78:7a, where an additional fifteenth "part" is added to the regular fourteen parts of light. As in chapter 73, the present unit was abbreviated from a longer source.

2.2.5 *The Second Lunar Treatise, Part II:* 1 En *78:10–79:6*

2.2.5.1 *The Original Order of Chapters 78–82*

We must now interrupt our sequential discussion of the lunar passages in order to examine the order of the text at the conclusion of the Ethiopic AB. It is almost universally accepted that the final chapters of AB do not reflect the original order of composition. Evidence from the Aramaic fragment 4Q209 26—where the transition point of chapters 78–79 is differently presented—partially supports this claim. Another significant contribution made by the Aramaic fragments has been the demonstration of the existence of a substantial text unit on the stars. Remnants of this unit are represented in 4Q211 ii–iii,

[74] Neugebauer, "Appendix A," 410; see also Hartum, "Enoch," 92; E. Isaac, "1 (Ethiopic Apocalypse of) Enoch," in *The Old Testament Pseudepigrapha* (ed. J.H. Charlesworth; NY: Doubleday, 1983), 57.

[75] Charles, *The Book of Enoch*, 168, deduced from 78:9 that the author was aware of Callippus' 76-year cycle, which may have required the occasional use of a 28-day month. The use of a 28-day month in the Callippic cycle is not certain, however, nor is it referred to in the Enochic text: see, for example, Stern, *Calendar and Community*, 6–7. While Beckwith has recently considered the presence of the Callippic cycle in 78:9 favourably, he fails to answer the objections raised by Stern: R.T. Beckwith, *Calendar, Chronology and Worship: Studies in Ancient Judaism and Early Christianity* (AJEC 61; Leiden: Brill, 2005), 51–53.

immediately following the text parallel to chapter 82 of the Geez.[76] The modern scholar therefore faces the need to rearrange the ending of AB utilising the clues found in the textual versions and a large amount of detective work.[77]

Chapters 78–82 constitute a conglomerate of various themes, represented in small fragments as short as one verse. Although it would be difficult—and perhaps futile—to attempt to explain the precise way in which the present textual disarray came into existence, a balanced examination of the subject matter will demonstrate that the assumption that such confusion occurred is unavoidable. At least four themes can be distinguished in chapters 78–82:

1. Themes which belong to the second lunar treatise of AB
2. Programmatic statements serving as a conclusion to the entire AB or to concrete sections within it
3. Remains of technical passages on the stars
4. Non-astronomical material: the narrative and admonition preserved in 80:1–82:4a.

Each of these themes is represented by several short subsections. Neugebauer is of the opinion that 79:1 initially formed the original conclusion of AB and that the material following this verse constitutes "fragments from additional versions."[78] We shall demonstrate, however, that such a conclusion seriously undervalues this collection of fragments.

The question of the originality of chapters 80–81 (more precisely, 80:1–82:4a) has been extensively discussed in previous research and need not be repeated here. Most of the arguments have been conveniently summarized in recent works by VanderKam, Nickelsburg, and Olson,[79] leaving only a few points to be considered

[76] Milik, *The Books of Enoch*, 296–97.

[77] The present formulation was devised independently of the similar one proposed by Olson, *Enoch*, 273–76. Although it shares much with Olson's view, the two differ on significant points.

[78] Neugebauer, "Appendix A," 387.

[79] J.C. VanderKam, "1 Enoch 80 within the Book of the Luminaries," in *From 4QMMT to Resurrection: Mélanges qumraniens en homage à Émile Puech* (STDJ 61; ed. F. García Martínez, A. Steudel, and E. Tigchelaar; Leiden: Brill, 2006), 333–55; idem, *Enoch and the Growth of an Apocalyptic Tradition*, 78–79; Nickelsburg, *1*

in brief here. It is to be expected that we should find redactional interests intertwined at points of transition and conclusion. While the composition of 78–82 involved, first of all, the incorporation of technical data belonging to the second lunar treatise, it ultimately also had to conform to the editorial interests of the entire *Book of Enoch* in some form.

Rather than constituting a continuous unit, the stretch of text in 80:1–82:20 and beyond should be divided into sense units on the basis of form-critical criteria. The congruence of each of these units with the cosmological argument in AB must be carefully examined. The narrative and admonition of chapter 81 extend to 82:4a, while 82:4b–8, 9–20, as well as the additional material from 4Q211, are technical in nature.

The fact that chapters 80–81 contain "ethical" material does not *a priori* preclude the possibility that they formed part of the original AB. It is perfectly possible that—like other Enochic compositions—AB contained general hortatory texts which comprised a religious framework for the scientific material. Olson has pointed out "the contrast between rebellious sinners and orderly nature featured in each of the other booklets (chapters 2–5; 41; 60; 83:10–84:6; 100:10–101:9)."[80] Such a combination of science and ethics can be seen in other texts quite close in genre—notably the Aramaic texts from Qumran, and particularly 4Q561.[81] Despite the above considerations, an examination of the text units in *1 Enoch* 78–82 reveals that chapters 80–81 are *not* in fact coterminous with AB.

It is increasingly acknowledged that chapters 80–81 are associated with some of the general redactional interests of one or more of the compositions in *1 Enoch*. Early on, Charles pointed to chapter 81's connection with chapter 91 from the Epistle of Enoch.[82] Argall and Nickelsburg have further demonstrated the links between chapters 80–81 and the Book of Watchers, viewing the former as the lost

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Enoch 1, 334–37; Olson, *Enoch*, 275–76. For a summary of earlier opinions, see García Martínez, *Qumran and Apocalyptic*, 57–60.

[80] Olson, *Enoch*, 275–76.

[81] See S. Holst and J. Høgenhaven, "Physiognomy and Eschatology: Some More Fragments of 4Q561," *JJS* 57 (2006): 26–43.

[82] Charles, *The Book of Enoch*, 148. On the connections of chapter 80 with the Epistle, see VanderKam, "1 Enoch 80 within the Book of Luminaries," 355.

conclusion to that Enochic booklet.[83] Even if Nickelsburg's hypotheses on the composition of *1 Enoch* are not fully accepted, the redactional activity in chapters 80–81 cannot be dismissed.

We may now to endeavour to elucidate the internal structure of the second lunar treatise from the contents of chapters 78–79. We have already defined 78:1–9 as a distinct section which discusses the amount of light in the moon. 78:10 clearly opens a new section, as seen from the sentence "Uriel showed me another law." As indicated in 78:10b, the subject matter of this section is the amount of light in the moon during the lunar month as a function of its distance from the sun. This theme is followed coherently in 78:11–14, 17, while vv. 15–16 expound an entirely different topic, focusing on the lunar *year* rather than on the lunar month.

The six verses of chapter 79 are internally inconsistent in form and content. V. 1 presents a programmatic statement: "Now my son I have shown you everything, and the law of all the stars of the sky is completed." This statement is continued in vv. 2 and 6, while vv. 3–5 diverge to discuss lunar data and seem to fit better with chapter 78.[84] The lunar data contained in vv. 3–5 is not congruent with the title on the stars in v. 1. In fact, the primary discussion of the stars in AB presently stands at the end of the composition, in chapter 82 and in the additional Aramaic passage of 4Q211 ii–iii. 79:1, 2 and 6 may consequently either have constituted a conclusion to the second astronomical treatise or a conclusion to the entire AB.[85]

[83] R. Argall, *1 Enoch and Sirach: A Comparative Literary and Conceptual Analysis of the Themes of Revelation, Creation and Judgment* (SBLEJL 8; Atlanta: Scholars Press, 1995), 257–65; Nickelsburg, *1 Enoch 1*, 334–37. See further K. Koch, *Vor der Wende der Zeiten: Beiträge zur apokalyptischen Literatur: Gesammelte Aufsätze Band 3* (ed. U. Glessmer and M. Krause; Neukirchen-Vluyn: Neukirchener, 1996), 13–14; Kvanvig, *Roots of Apocalyptic*, 59, 73–79. Nickelsburg's hypothesis is conveniently discussed by several scholars, with responses by Nickelsburg himself, in *George W.E. Nickelsburg in Perspective: An Ongoing Dialogue of Learning* (JSJSup 80; ed. J. Neusner and A.J. Avery-Peck; Leiden: Brill, 2003), 368–69, 374–76, 380–83, 414–17; M.A. Knibb, "Interpreting the Book of Enoch," 440–42.

[84] Cf. Kvanvig, *Roots of Apocalyptic*, 56.

[85] Charles, *The Book of Enoch*, 148–49; cf., somewhat differently but in agreement with regard to the role of chapter 79, VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*, 77–79.

The Aramaic fragments demonstrate that the present order of chapter 79 was not the original. The pertinent text is 4Q209 frg. 26 (DJD XXXVI, 163):[86]

2]בׄתרעא שתיתיא בה̊[

3 שבעין חמש ועשרין וי]ומין תרין ומחסר מן דבר שמשאׄ[

4]oo בה כדמות חזיׄ דמי כדי נהורה בה הא̊י[ר

5 בליליא מן]ק̊צׄת דמי חזוא דן כדמות אנשׁ[ ]ו̊בימּמא מן[קצת

6 נהור]ה בלחודהי וכען מחוה אנה לך ברי

7]ח̊שבון אח̊[ו]°נ̊[י

2 (79:3)]through the sixth gate. Through it [

3 (79:4) twenty five weeks and] two [d]ays. (79:5) And it falls behind the course of the sun [

4] in it. It resembles the likeness of a mirror[87] when its light shi[nes] on it [

5 (78:17) In the night, for] part (of the time), this appearance looks as if it was the image of a man; and by day for [part (of the time)

6] her [light] only. (79:1) And now I am showing to you, my son *vacat*

7] a calculation he sho[w]ed [me

The order in the Aramaic fragment is 79:3–5 > 78:17 > 79:1, leading to the fact that all the technical data is concentrated before the concluding statement of 79:1. This phenomenon constitutes conclusive proof that 79:3–5 originally formed part of chapter 78. Its present placement may be the consequence of an error, as suggested

[86] Cf. Milik. *The Books of Enoch*, 295; Black, *The Book of Enoch*, 417–18. Milik maintained that 4Q209 frg. 25 parallels *1 En* 79:1, but this view was refuted by Black, as well as by Tigchelaar and García Martínez, DJD XXXVI, 162.

[87] This translation of חזי/חזו, first suggested by Black, *The Book of Enoch*, 418, is to be preferred over Milik's "vision." The Aramaic חזי translates the Hebrew "מראה mirror" in the Fragment Targum to Exod 38:8 but not in Targum Onqelos (מחזיתא): see M. Jastrow, *A Dictionary of the Targumim, the Talmud Babli and Yerushalmi, and the Midrashic Literature* (NY: Chorev, 1926), 758; M. Sokoloff, *A Dictionary of Jewish Palestinian Aramaic* (Ramat Gan/Baltimore: Bar Ilan University Press/Johns Hopkins University Press, 2002), 194.

by Olson, or of a deliberate transition by a redactor, as suggested by K. Koch.[88]

Important as this testimony is, 4Q209 frg. 26 does not indicate which verse in chapter 78 preceded 79:3. Furthermore, the order 79:3–5 > 78:17 does not make good sense. The data in 78:10–17, 79:3–5 can be divided thematically as follows:

> (a) 78:10–14: the amount of light in the sun and moon and their relative placement at key stations within the lunar month (conjunction and opposition)
>
> (b) 78:15–16: length of two discrete halves of the lunar year
>
> (c) 78:17: some unusual similes describing the form of the moon in key stations within the lunar month
>
> (d) 79:3–5: a gap of five days between half of a lunar year and half of a schematic year

While units (a) and (c) describe the lunar month—not a particular month but a pattern for any given month—units (b) and (d) relate to the length of the lunar *year*. More specifically, both these units note the peculiar time period of half a lunar year. Only units (b) and (d) mention the heavenly gates. The gates are not mentioned elsewhere in chapter 78—with the exception of a very general note in v. 5. Units (b) and (d) must therefore have been related. 79:3–5 may have constituted an expansion of 78:15–16 (Neugebauer) or simply its continuation (Olson).[89] The unit 78:15–16 + 79:3–5—whether one continuous passage or two distinct fragments—discusses the length of the lunar year and its divergence from the 364-day schematic year. It also describes, in rather obscure fashion, the path of the moon in the heavenly gates. The text units (a) and (c) also comprise a continuous unit, originally including 78:10–14, 17.[90] This latter unit discusses the amount of light in the moon and its form during the lunar month.

[88] Olson, *Enoch*, 275, opts for misplacement. Koch, *Vor der Wende der Zeiten*, 10–12, suggests that the present order was produced by a redactor who intended to disseminate the scientific material of the original AB within the apocalyptic material to which he attached it. Since the redactor considered 79:3–5 to constitute a significant statement with regard to the triennial cycle, it was important for him to place these verses immediately prior to the theological declaration of chapter 79.

[89] Neugebauer, "Appendix A," 411; Olson, *Enoch*, 275, and esp. 166.

[90] On this point, too, I concur with Olson, *Enoch*, 166.

The order suggested here only partially agrees with the order in the Aramaic fragment 4Q209 26. The latter presents a blurred sequence of the technical data, since it places 78:17 immediately after 79:3–5, thus mixing the two types of lunar discourse. We must therefore conclude that the character of the second part of AB as a garbled collection of fragments did not originate with the Ethiopic scribes and translators but that the order of this stretch of text was already confused in the Aramaic transmission. The Ethiopic scribes did not obfuscate an originally lucid document but put their best efforts into imposing order on a text that had reached them in an incoherent thematic sequence.

2.2.5.2 *The Second Lunar Treatise, Part III: Comments on* 1 En *78:10–14, 17*

As in 73:5–8 and 78:1–9, the present pericope describes the amount of light in the moon over the course of a lunar month. In correspondence to 73:7, it employs a system for tracing the place of the moon which is not based on the heavenly gates. This method receives special elaboration in 78:10–14, being based on the contrast between the conjunction of sun and moon at the beginning of the month and their opposition in the middle of the month. Since the moon receives its light from the sun (78:10), it is not visible at conjunction, when the two luminaries are in close proximity to one another, while at opposition its full disc is lit. This simple principle also explains further lunar phenomena. The first visibility of the moon occurs on the west horizon on the evening prior to day 1, very close to sunset; in contrast, the full moon is seen in the east at the same time as the sun sets in the west. Consequently, on the evening of first visibility the moon is seen for a very short period of time, while at full moon it is seen throughout the night.

After an introductory statement in v. 10, the advance of the moon in the first half of the lunar month is depicted in v. 11. Full moon is recorded on day 14, as in chapter 73 but unlike 78:7. Since vv. 12 and 13 return to describe conjunction (12) and opposition (13), however, it is possible that v. 11 merely introduces the general principle, elaborated in the following verses.

V. 14 relates to yet another aspect of the moon's orbit, observing somewhat obscurely that "from the place where light comes to the moon, from there again it decreases until all the light is exhausted."[91] V. 17 continues the issues raised in v. 14, as attested by the similar phrase *zaʾənbala bərhān* "without/except for light" in both verses. Although the exact reading and interpretation of v. 17 is unclear,[92] the verse evidently relates to lunar visibility during daytime and night time through the month, a theme also discussed in v. 13. This topic was also a traditional element in early stages of Mesopotamian lunar theory, notably in EAE 14 (see below 4.1.5).[93]

In summary, both 78:1–9 and 78:10–14, 17 relate to the amount of light in the moon through the days of the lunar month. The latter pericope is unique in its note of such other lunar phenomena as the length of lunar visibility, as well as some notions of conjunction and opposition. It is difficult to locate the sources for this unit in the EMLV.

2.2.5.3 *The Second Lunar Treatise, Part IV: Comments on* 1 En *78:15–16, 79:3–5*

In contrast to the span of one month in 78:10–14, 17, the pericope of 78:15–16 relates to the entire lunar year, dividing it into two halves of six months each, with the number of days in each half amounting to 177. This is the sum of days in three full months (3 x 30) plus three hollow months (3 x 29). 79:3–5 further notes a gap of five days between 177 days and 182 days (182–177 = 5)—i.e., between the lengths of a half of a lunar year and a half of a schematic 364DY. Olson has further demonstrated the continuity between 78:15–16 and 79:3–5.[94] It should be noted that the calculations of 79:5 follow the

[91] Both renditions "from the place" (Nickelsburg-VanderKam) and "on the side" (Knibb) are quite free, since the Geez rather dully reads *ʾəmḫ̮aba*, "whence."

[92] The best interpretation thus far is Black's, *The Book of Enoch*, 417–18, accepted also in DJD XXXVI, 164. This accounts both for the Aramaic text of 4Q209 frg. 26 and for the mysterious number "twenty" in the first half of v. 17, although it is not entirely coherent from an astronomical point of view.

[93] B.L. van der Waerden, "Babylonian Astronomy III: The Earliest Astronomical Computations," *JNES* 10 (1951): 22–34; H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (HdO I, 44; Leiden: Brill, 1999), 44–50.

[94] Olson, *Enoch*, 166.

same line of thought as in 74:13–14 when calculating the time gap between the lunar year and the schematic 364DY. Both passages belong to the "Moon Type III" group as defined above (2.2).

Albani notes that the 354-day length of the lunar year is never properly indicated in AB.[95] The two passages that come closest to giving this figure are 74:10–16—where the figure is implied from multi-year calculations—and 78:15–16, where the length of half a year alone is given as 177 days. Albani raises the possibility that the Enochic authors were reluctant to assign the title "year" to a 354-day period, since a proper year can only be a 364DY.[96] Thus, each half of the lunar year is neutrally termed *zaman* "period."

An important aspect in the count of days is the fact that the 177 days of the half-lunar-year are divided into units of seven. Thus 79:4 reads: "until 177 days are completed, by the law of the week (*baśərʿāta sanbat*) twenty five (weeks) and two days." Such commitment to the septenary ideology is not common in AB (see above 1.4.1), being more reminiscent of the counts in the *Book of Jubilees*—for example, *Jub* 23:8. Curiously, this count does not apply to the days of the 364DY but rather to the non-septenary lunar year of 354 days.[97]

Side by side with Type III lunar calculations, the present pericope also records the place of the moon in the heavenly gates, indicating that it also belongs to the "Type II" model. This connection is made very loosely, however. Although the gates are repeatedly mentioned (78:15, 79:3–4), these references do not entirely conform to the detailed model of the EMLV or chapter 74. With Neugebauer, it should therefore be maintained that "the first gate" and "the sixth gate" in 78:15 and 79:4 do not use the same numbering of gates from south to north as employed in previous chapters but refer instead to "the first gate from which the moon rose at the beginning of the year" and the sixth gate counting from the one mentioned above—i.e., gates

[95] Albani, *Astronomie und Schöpfungsglaube*, 69.

[96] Note that the Hebrew phrase *šanah temimah* (Lev 25:30) forced such an eminent rabbinic authority as R. Yehuda ha-Nasiʾ to discard the rabbinic lunar year and adopt the 365-day solar year in regard to the particular matter where that phrase is mentioned (*m. ʿArak.* 9:3).

[97] The count of weeks in 79:4 is possibly linked to typical Ethiopic methods of time reckoning: see Neugebauer, *Ethiopic Astronomy and Computus*, 226.

number 4 and 3 according to the conventional numbering.[98] A comparison of the model of chapters 78:15–16 + 79:3–5 with that of chapter 74 reveals the existence of a certain similarity between the two texts. The relatively clear account in chapter 74 concerns the equinoctial months, as do chapters 78–79 in their own obscure fashion, in concentrating on the beginning and end of every half-year.

The short pericope 79:3–5 thus combines three different aspects of schematic astronomy: (1) the waxing and waning of the moon (no parts of light are counted); (2) the place of the moon in the heavenly gates; and (3) the gap created between the lunar year and the 364DY. In comparison, chapter 73 covers item (1) only; chapter 74 covers items (2) and (3); while the EMLV combines (1) and (2) but not (3). The unit 79:3–5 may thus attest to a comprehensive and advanced lunar model. However, the fact that this unit is so badly preserved makes it difficult to reconstruct the system reflected in it.

2.2.6 *Summary: Lunar Theory in AB*

The discussion thus far has confirmed Neugebauer's theory that the Ethiopic AB comprises two separate treatises. It is now possible to refine and develop this view. A first treatise existed in chapters 72–75(76?), incorporating the lunar chapters 73–74 (for chapters 75–76 see below). A second treatise is represented in chapters (77?)78–79 and 82:4b–20, with the main treatment of lunar theory appearing in chapters 78–79. While the first treatise is known from the long Aramaic EMLV and a short Geez version, the second treatise is only known in a short version (preserved in both Aramaic and Geez).

Lunar theory forms the central part of each treatise not only in terms of the amount of text it covers but also with regard to its thematic importance. While the solar models of chapter 72 provide the infrastructure for the geography of heaven, the harmony sought by the authors of AB was not obtainable without an adequate model for the synchronization of sun and moon. It is thus the lunar chapters that constitute the heart of the argument. Accordingly, they supply the

[98] Neugebauer, "Appendix A," 411.

justification for such programmatic statements as *1 En* 74:12 and 74:17.

The main theoretical elements of the lunar model are as follows:

1) Time periods of lunar visibility and invisibility during daytime and night time. These are meticulously recorded in the EMLV according to a scheme which closely resembles that of EAE 14. The scheme is elaborated below 4.1.5 and 4.2.4.

2) The amount of light in the moon, counted by the number of illuminated parts.

3) The system of heavenly gates as a means for expressing the sun's position. This element is systematically presented in chapter 72 and also included in the EMLV.

4) The system of heavenly gates as a means for expressing the position of the moon on the horizon (summarized in TABLE 2.1 above). This element fails to reveal any awareness of the moon's orbit on the ecliptic.[99]

5) Other methods for calculating the place of the moon with respect to the sun.[100] The ecliptical elongation of the moon is measured in units of $^1/_7$ or $^1/_{14}$ of its entire orbit. This system is employed in 73:5, 8 and more simplistically in 78:10–14, both sources going back to such passages as 4Q209 6 9. The method implies an awareness of the ecliptic on the authors' part, although admittedly one which is rather vague.

6) Length of daytime and night time, measured by 18 parts per nychthemeron. This system appears in chapter 72 and reflects the teaching in EAE 14 (see below 4.1.1 and 4.2.2).

7) The gap between the lunar year and the schematic 364-day year.

[99] See, however, the *Excursus* below 4.3.3.

[100] Albani briefly discusses this alternative method in *Astronomie und Schöpfungsglaube*, 88–89.

The distribution of the astronomical elements in the various sources is summarized in TABLE 2.4.

Textual Units → **Theoretical Elements ↓**	**EMLV**	**Sun**	**Moon I**	**Moon II**	**Moon III**
1. Periods of lunar visibility	V	—	V(?)	—	—
2. Amount of light in the moon (parts)	V	—	V	—	—
3. Sun in heavenly gates	V	V	—	—	—
4. Moon in heavenly gates	V	—	—	V	V (?)
5. Moon on the "ecliptic"	—	—	V	—	—
6. Length of daylight	—	V	—	—	—
7. Day gap between lunar and schematic years	—	—	—	—	V

TABLE 2.4: Distribution of thematic elements in the versions of AB

The lunar theory of AB is characterised throughout by the tension between the ecliptical motion of the moon and its projection on the horizon. The theory oscillates between the true motion of the moon and the schematic models designed to convey it.[101] The ideological aim of the scheme is expressed at the end of the first treatise, in a concluding statement which has only been preserved in the Geez version. Once the author had completed his elaborate lunar model, he apparently felt sufficiently secure to declare (in 74:17) that the required harmony of sun and moon was accomplished, although it could only be based on the schematic 30-day month. In Neugebauer's words:

[101] Cf. Albani, *Astronomie und Schöpfungsglaube*, 90–91.

> It is clear that the arithmetical patterns which describe the variation of the lunar phases … assume a schematic month of 30 days. In another context, however … a lunar year of alternating full and hollow months is assumed. Such flagrant inconsistencies did not disturb the men who wrote or used these treatises.[102]

While on purely theoretical grounds the moon should have acted according to schematic months alone, the author does not entirely ignore the alteration of hollow and full months and the number of 354 days in a lunar year. A solution for this anomaly can be found only in the form of the triennial cycle, a device known to us from the Qumran calendars. The triennial cycle is never made explicit in either the Aramaic or Geez versions of AB, although it does seem to have been implied in the original form of 74:10–16, discussed below in Chapter 3.

2.3 Stars in AB

Two passages in the Geez AB—75:1–3 and 82:4b–8—mention the role of the stars. Although not particularly instructive as scientific literature, these two units are crucial for the understanding of the composition of AB. Following Dillmann's initial insight, we note that these two passages in fact constitute reworked versions of the same original text unit, which initially served as a conclusion to the astronomical treatises.[103] While the question of the status of the epagomenal days is raised in these passages, possibly by the redactional hand discussed above (1.3.1.1), it clearly does not form their primary focus. Their intention was rather to depict the stars as the leaders of Time and to identify them with the four epagomenal days at the turn of the seasons. We shall examine the two nearly-parallel passages in some detail, presenting them first in tabular form.

[102] Neugebauer, *Ethiopic Astronomy and Computus*, 197. Although this passage relates to Ethiopic texts, it is equally applicable to AB.

[103] Dillmann, *Das Buch Henoch*, 232. The following Table precludes the separation of 82:4b–8 into two discrete parts as suggested by Olson, *Enoch*, 169, 177, 275.

75:1–3	82:4b–8
1 The leaders of the heads of the thousands who are over all the creation and over all the stars	4 with the heads of thousands of the order of the stars
With those four (days) that are added	With the four additional ones … with the four days
They are not separated from their work/position[104] according to the calculation of the year	That divide between the four parts of the year
And they serve on the four days that are not reckoned in the calculation of the year	5b and do not calculate them in the numbering of the entire world[105]
2 People err regarding them	5 people err regarding them … because they err regarding them
Because those lights truly serve (in) the positions of the world	6 for they belong in the reckoning of the year and are indeed recorded forever
One in the first gate, one in the third heavenly gate, one in the fourth gate, and one in the sixth gate	One in the first gate, one in the third gate, one in the fourth, and one in the sixth
The year is completed[106] precisely in the 364 positions of the world	A year of 364 days is completed
3 For Uriel … showed me the sign, the seasons, the year and the days	7 ... because the luminaries and the months, the festivals, the years, and the days he showed me, and Uriel[107]
The angel whom the Lord of eternal glory[108] set over all the heavenly luminaries	and Uriel, to whom the Lord of the entire creation gave orders for me regarding the host of heaven
… so that they may rule the firmament, appear above the earth, and be leaders of days and nights	8 he has power in heaven over night and day to make light appear over humanity

[104] For the variant readings, primarily in ms Tana 9, see Uhlig, *Das äthiopische Henochbuch*, 650, note d.

[105] Once again, ms Tana 9 presents a variant reading: see ibid, 668, note c.

[106] The reading here follows ms Tana 9 (preferred by Uhlig and Olson), while the majority of other mss read “and the accuracy of the world is completed” (preferred by VanderKam, Knibb, et al.). It would appear that in these manuscripts the word ʿ*āmat*, “year” was changed to ʿ*ālam*, “world,” a variant which occurs elsewhere in AB.

[107] The words “and Uriel” may also belong to the first part of the verse, as in Knibb’s translation: “for the lights and the months … Uriel showed me” (cf. Uhlig).

[108] Uhlig (ibid) discusses some variants regarding this epithet.

The sun, the moon, the stars, and all the serving entities that go around in all the heavenly chariots[109]	The sun, the moon, the stars, and all the heavenly powers which revolve in their circuits

There can be no doubt that these two passages stem from an original single passage. This text had originally emphasised the identity of the epagomenal days as stars standing at the turn of the seasons. It underwent an elaborate *Überlieferungsgeschichte*, the products of which were placed at the end of each of the treatises in AB. Generally speaking, 75:1–3 is closer to the original than 82:4b–8, the latter having apparently undergone a more extensive redaction.[110]

The integration of the original unit into larger stretches of text in the two treatises of AB helped produce a different message in each of the two resulting passages. 75:1–3 is followed by 75:4–9, which continues the thought of the first three verses and connects the stars to aspects of winds and weather. It displays no special objection to the stars, and possibly even preserves the only reference in AB to a specific constellation, most probably the Wagon (in 75:8–9). In contrast, some of the paragraphs which follow 82:4b–8 underscore the role of angels, rather than the stars, in dividing the seasons:

> 82:9–12: order and titles of the various leaders
>
> 82:13–20 + 4Q211 i: weather in the annual seasons[111] + names of leading angels

One of the central tendencies in 82:9–12 is to replace the stars with angels as the entities responsible for the division of time (see 1.2). This tendency becomes fully explicit later on (82:13ff), where angels rather than stars are named as leaders of the seasons. The originally identical passages were therefore reworked internally and

[109] Ms Berlin (Charles ms q) reads here *sarwet*(!), "host (of heaven?)," as reported in Knibb's apparatus, instead of the more common reading *sargallāta samay*, "chariot of heaven."

[110] I hope to dedicate a separate study to the variants and expansions in this passage.

[111] The weather is a common interest in both chapters 75 and 82, although expressed in different ways.

contextually, yielding divergent products, with an anti-stellar tendency dominating the ultimate and longer edition represented in 82:4b–20.[112]

2.4 Conclusion: AB's Composition and Thematic Structure

In its various versions, AB contains alternative endeavors to transmit a basic astronomical method. Many elements of this method—although surely not the entire method—were contained in the Aramaic EMLV. These, together with other elements not included in EMLV, were reworked and refashioned in a complex process which yielded two or more alternative astronomical treatises. These treatises were in turn later merged into a continuous AB. The second treatise (chapters 77–79, 82) is already attested in Aramaic, while the first is attested only in Ethiopic. At least one continuous version of AB therefore existed already in Aramaic. The structure of the two treatises is described in the following table (see page 117).

The reworking of AB involved a conceptual refashioning of the original, reflecting a certain degree of independent reasoning on the compiler's part. While the EMLV provided an integrated account of the orbits of sun and moon, the compiler of the Book of Astronomy employed an analytical method, treating each aspect separately. Consequently, in place of the continuous roster we now see two distinct treatises on the sun (chapter 72), the moon (chapters 73–74, 78–79), and the stars (chapters 75 and 82). The first of the two astronomical treatises is relatively well preserved, while the second treatise was damaged in the course of transmission. With regard to lunar theory, the compiler distinguished units devoted to aspects of Time from those dealing with aspects of Space, designated above "Moon I" and "Moon II" types.

[112] Albani, *Astronomie und Schöpfungsglaube*, 248–60, dubs this tendency "anti-astrological."

	Treatise I Chapters 72–75 (76?)	**Treatise II Chapters 77–79, 82:4ff**
Sun	Chapter 72	—— [113]
Moon Type I	Chapter 73	78:6–9 78:10–14, 17
Moon Type II	74:1–9, 17	79:3–5
Moon Type III	74:10–16	78:15–16 79:3–5
Stars (associated with angels or with weather)	Chapter 75	82:4–20 4Q211
Winds and weather	Chapter 76	Chapter 77

TABLE 2.5: A thematic layout of the two treatises incorporated in AB

The observations presented here are based on the contention that the longer and more elaborate text preceded the shorter version. The shift from the tedious Aramaic roster to the more "elegant" analytical chapters of the AB represents a natural way of reworking the material. Indeed, this line of progression—from the synthetic to the analytic—affected the later development of astronomical and calendrical thought in such Qumran documents as 4Q317 and the *mišmarot* texts 4Q320–4Q321.

The work of abridgement was not carried out by translators, whether Greek or Ethiopic. On the contrary, an abridged Aramaic version existed prior to the Greek translation and served as its *Vorlage*. The literary phenomena we encounter in the AB are characteristic of reworking rather than of translation. The pristine version of AB, whatever it may have been, was copied, reworked, and expanded in ancient times as befitted an authoritative text. In fact, AB received similar treatment to that of other authoritative texts in Qumran—and ancient Jewish literature as a whole.[114] The two

[113] In the absence of a solar model in the second treatise, one may perceive traces of this unit in the information given on the sun in 78:1–5.

[114] Cf. G.J. Brooke, "The Rewritten Law, Prophets and Psalms: Issues for Understanding the Text of the Bible," in *The Bible as Book: The Hebrew Bible and the Judaean Desert Discoveries* (ed. E.D. Herbert and E. Tov; London: The British Library, 2002), 31–40.

alternative recensions of AB, each of which comprised a comprehensive cosmological treatise, represent multiple attempts at producing a short version of the authoritative but cumbersome original. We may thus ascribe a textual fluidity to the Book of Astronomy in the early stages of its transmission.

CHAPTER 3

THE TRIENNIAL CYCLE

Although the 364DY creates the framework for cycles of three, six, seven, forty-nine years, etc., the basic year cycle in the 364DCT is the triennial cycle. This cycle is based on the ten-day gap between the lunar year (354 days) and the schematic 364DY, according to the equation:

$$3 \times 364 = 3 \times (354 + 10)$$

This scheme allows for the synchronization of the lunar and schematic cycles by the addition of a 30-day month at the end of every third lunar year. 36 schematic months thus equal 37 lunations. This basic insight is implied in some form in AB (74:13–16) and constitutes a fundamental element in the 364DCT until the triennial cycle merges into the six-year *mišmarot* cycle. The present chapter examines, conceptually and textually, the mechanism of a "cycle of years" as it is reflected in various texts, including the different versions of AB and selected texts from Qumran.

3.1 The Schematic Year

Why are year cycles needed, and what level of knowledge is required in order to implement them? These issues were recently addressed by Leo Depuydt, who proposed the following outlines for a developmental model:

Stage 1: Use of natural time cycles: day, month, year

Stage 2: The merging of the various natural cycles into a single lunar/solar/luni-solar year

Stage 3: Fashioning cycles longer than one year.[1]

[1] L. Depuydt, *Civil Calendar and Lunar Calendar in Ancient Egypt* (OLA 77; Leuven: Peeters, 1997), 24–31.

The term "year" (*šanah*, *annus*, *etos*, *ʿāmat*, *šattu*) covers a range of highly divergent meanings. It primarily denotes the tropical solar year: a defined physical unit reflecting the period of time between two consecutive dates of the spring equinox. In both ancient and modern languages, the term "year" is also frequently used to denote the lunar "year"—an arithmetical entity defined as a period of twelve lunar months. The notion of a lunar "year" is a *Mischwesen*, devised in order to achieve a reasonable degree of synchronization between the solar year and another physical unit—the month—which relates to the orbit of the moon. As long as only one parameter is employed by a certain society—either moon *or* sun—no need arises for either intercalation or year cycles. Since many human societies chose to take both solar and lunar phenomena into account, however, the introduction of year cycles became a necessity. According to the model established by Depuydt, in stage (2) intercalation and the creation of year cycles are random, even haphazard: the regulation of the calendar only occurs *ad hoc*, when a problem arises. Only later (stage 3) is intercalation stabilized by fixed rules and recurrent year cycles.

The problem of synchronizing distinct natural time units is amenable to another solution. The schematic year was fashioned in order to account for all possible natural time units. The call for a schematic year arose first and foremost from the need for long-range calculations. The best example is the 360-day year developed by Sumerian scribes in the fourth millennium B.C.E.[2] These scribes' preoccupation with calculations regarding tax payments, reimbursement of loans, land tenure, etc., required them to keep accounts for periods longer than one year. Under the constraints of an unstable calendar regulation in which each calendrical year contained a different number of days, this was a difficult task. The Sumerian scribes consequently sought to create a schematic year of a fixed length.[3] The ancient Egyptian civil year of 360 + 5 days was equally

[2] See H.J. Nissen, P. Damerow, and R.K. Englund, *Archaic Bookkeeping: Early Writing and Techniques of Economic Administration in the Ancient Near East* (trans. P. Larsen; Chicago: Chicago University Press, 1993), 36–37. It is possible that a schematic 364-day year was also used for administrative purposes at Ebla: see A. Archi, "Tables de comptes eblaïtes," *RA* 83 (1989): 1–6.

[3] On administrative uses of the year, see also F.H. Cryer, "The 360-Day Calendar Year and Early Judaic Sectarianism," *SJOT* 1 (1987): 116–22. For the sake of comparison, the present-day Jewish calendar is awkward for use in banking and

useful for long-term calculations, reflected in its persistent use over three millennia. The Roman author Macrobius praised the Egyptian calendar precisely for this reason: "The Egyptians, alone and always, had a year of definite length. Other peoples varied it by different but equally erroneous reckonings."[4] The main virtues of the schematic year are its simplicity and the fact that its length remains fixed.

The schematic year of 360 days was not only used in Mesopotamia for financial needs. Close to the standardization of the great astronomical-astrological compendia *Enūma Anu Enlil* and Mul.Apin at the end of the second millennium B.C.E., the ideal measure for astronomical calculations was also established as 360 days.[5] Although the Babylonian and Assyrian astronomers were undoubtedly aware that this ideal number does not conform to the actual celestial orbits, they maintained the 360-day year as appropriate for their calculations because the crude 360-day year served as a useful tool for developing other, more accurate numerical models. When a correction was needed in the civil calendar—a quite frequent occurrence—the astronomer would report it *ad hoc* to the authorities and call for an intercalation.[6] In this way, the ideal schemes were not discarded but served as a basis to which corrections were recurrently applied.[7]

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economy because it is frequently intercalated, a fact which requires considerable modifications of the calculating methods. The Israeli banking system uses the Gregorian calendar, which functions as a civil and schematic calendar.

[4] Quoted in E.J. Bickerman, *Chronology of the Ancient World* (London: Thames and Hudson, 1980²), 40.

[5] W. Horowitz, *Mesopotamian Cosmic Geography* (Winona Lake, IN: Eisenbrauns, 1998), 163, 174; J.P. Britton, "Treatments of Annual Phenomena in Cuneiform Sources," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 23.

[6] See, for example, the words of the Assyrian astronomer Balasî: "Let them intercalate a month! All the stars of heaven are late. Let (the month of) Adar not pass unluckily. Let them intercalate it" (SAA VIII, §57, according to Horowitz, *Mesopotamian Cosmic Geography*, 164). The belatedness of the stars with regard to the civil calendar must be remedied, since it would otherwise produce a bad omen for king and kingdom. For the manipulation of the calendar in light of divinatory needs, see A.L. Oppenheim, "A Babylonian Diviner's Manual," *JNES* 33 (1974): 197–220; D. Brown, *Mesopotamian Planetary Astronomy-Astrology* (CM 18; Groningen: Styx, 2000), 120–22.

[7] For a recent interpretation of Mul.Apin according to this view, see L. Brack-Bernsen, "The 'Days in Excess' from MUL.APIN: On the 'First Intercalation' and 'Water Clock' Schemes from MUL.APIN," *Centaurus* 47 (2005): 1–29; contrast Brown, *Mesopotamian Planetary Astronomy-Astrology*, 115–20.

The schematic year in Mesopotamia and Egypt was customarily maintained alongside an additional form of year, usually lunar or luni-solar. The astronomers who employed the ideal schemes succeeded in maintaining both systems—schematic and solar/lunar—for many years without damaging the structure of the ideal schemes. It was only quite late in the development of astral speculation that the necessity to alter the year length in order to reflect more accurate figures was acknowledged—not only *de facto* but also *de iure*.[8]

The 364DY was developed in Mesopotamia as an improvement upon the 360-day year.[9] In later Mesopotamian literature, the realization dawned that even the "corrected" number 364 fails to provide a perfect solution, itself requiring periodical corrections. Since the 364DY did not exist long in Mesopotamia after the seventh century B.C.E., rapidly being replaced by more accurate numbers, we are unable to inspect how this anomaly was handled by Babylonian astronomers. In the following centuries, however, an abundance of Jewish material was based on the same type of year. This material presents us with a fertile ground for research into the issue of how the 364DY was adapted to fit multi-year cycles.

3.2 The Moon in AB: Ideological Aspects and Lunar Theory

Being schematic, the 364DY is by definition designed to function within the framework of a single year. Over time, however, the gap accumulated from the lunar year became so significant that the introduction of a longer cycle became inevitable. The question under investigation at present is whether AB itself knew of a cycle longer than one 364DY. Although a cycle of eight years (*octaeteris*) is described in 74:13–16, this most probably represents a later addition which does not reflect the authentic ideas of AB (see below 3.3). While scholars have commonly assumed the presence of a triennial cycle in AB, this supposition now seems much less definitive.

[8] Britton, "Treatments of Annual Phenomena," describes the growing awareness of the need for accurate year-lengths during the seventh century B.C.E.

[9] See W. Horowitz, "The 360 and 364 Day Year in Ancient Mesopotamia," *JANES* 24 (1996): 35–44; J. Ben-Dov and W. Horowitz, "The 364-day Year in Mesopotamia and Qumran," *Meghillot* 1 (2003), 8.

When we review the natural time-cycles which the schematic years of AB include, we see that the ideal 360-day year, as well as its sister phenomenon, the 364DY, are clearly represented in the solar models of chapter 72. Other statements in AB declare that the fixed stars act according to the same time framework (75:1–2, 82:4–6). No necessity therefore exists to deviate from a single 364DY in order to follow the orbits of the sun and the fixed stars (planets are not discussed in AB). The author of AB also seeks to explain the motion of the moon by the same spatio-temporal framework. This explanation appears in great detail in the "Expanded Model of Lunar Visibility" (EMLV; also known as "the Synchronistic Calendar") and in an abridged version (or versions) in AB chapters 73–74 and 78–79. While the former text gives no indication that a period other than one schematic year is considered, the latter reveals an awareness of the need to use longer or shorter time periods in order to close the gap with the lunar year. Thus in the passages designated Moon Type III (74:10–16, 79:3–5), various calculations of the time gap between the schematic year(s) and the lunar year appear, over the course of one half-year and three, five, and eight years. It is essential to note, however, that these calculations have no effect on the mechanical models employed in AB. Although the author is aware of the gap between the schematic year and the lunar year, the models supplied in AB for the orbits of sun and moon ignore it, acting exclusively within the framework of a single schematic year.

Having demonstrated how the moon's orbit can be explained in accordance with that of the sun, the author utters a solemn declaration in 74:17:

> Then the year is correctly[10] completed in accord with their [JBD: the lunar phases'][11] eternal positions and the positions of the sun; they rise[12] from the gate from which it rises and sets for thirty days.

[10] The adverb "correctly" is expressed by the Geez *baṣədq*, which translates the Greek δικαιοσύνη/δικαίω," based on the Aramaic בקושטא: see the glossary in J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976), 392; L.T. Stuckenbruck, "Revision of the Aramaic-Greek and Greek-Aramaic Glossaries in *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* by J.T. Milik," *JJS* 41 (1990), 34–35.

[11] The plural pronoun *ziʾahomu* negates the translation in the singular ("its") by Neugebauer: O. Neugebauer, "The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72 to 82)," "Appendix A" in M. Black, *The Book of Enoch or 1 Enoch* (SVTP 7; Leiden: Brill, 1985), 386–419. Both Knibb and Uhlig maintain that this pronoun

Even bolder is the announcement in 74:12:

> The moon[13] brings about the years precisely, all according to their eternal positions. They come neither early nor late by one day by which they would change the year: each is exactly 364 days.

These verses conclude the lunar treatise of chapters 73–74. The clear message they convey is that the moon traverses the same gates as the sun, and during the same time periods—i.e., in thirty-day intervals. The author's intentions are fully achieved here through the adoption of a single paradigm which explains the motion of all the luminaries, including those of the moon. While this process may seem strange to the observer accustomed to a 354-day lunar year, AB's conceptual perspective makes it unavoidable.

Although AB acknowledges time gaps with the lunar year, these are not incorporated into the technical models. Moreover, the author of AB never mentions a year number 2 or 3 in any cycle, nor does he refer to a year number 1. Although disguised under a thick layer of numbers and details, AB seeks to convey an ideological-theological message—namely that the luminaries act בקושטא "correctly" or "with justice" (74:12), and that their motion is best tracked by conforming strictly to the key numbers 360 or 364. The celestial harmony is maintained by the word of God, its mathematical facet being revealed to Enoch by Uriel, the angel in charge of the luminaries. Had the author of AB accounted for the orbits of the luminaries using a triennial cycle, he would have been compelled to acknowledge the inadequacy of the divine scheme and thus to deny its eternal validity. The existence of multi-year cycles was therefore recognized only from the numerical aspect relating to the equation of the number of days.

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refers to the lunar phases: M.A. Knibb, *The Ethiopic Book of Enoch* (Oxford: Clarendon, 1978), 2:174; S. Uhlig, *Das äthiopische Henochbuch* (JSHRZ V, 6; Gütersloh: Gütersloher, 1984), 650, on v. 17, note a.

[12] Once again in the plural (*yəśarrequ*): see Uhlig, *Das äthiopische Henochbuch*, 650, note c.

[13] This is the reading in all the Geez mss. Charles corrected it to "the sun," assuming that "the moon" at the beginning of the verse was mistakenly transferred from the previous verse: R.H. Charles, *The Book of Enoch or 1 Enoch* (Oxford: Clarendon, 1912), 160. This emendation is based on the erroneous assertion that the mss reading represents "the moon as the perfect time-divider in glaring contradiction with verses 10–11 and *Jub*. 6:36." Charles is followed by Kahana and Olson and opposed by VanderKam, Knibb, Uhlig, Neugebauer, et al. The contradiction with *Jub* 6:36 does not provide a sufficient reason to correct the Enoch mss without any manuscript support.

The preeminent example of such an equation is found in 74:10–16, although even there the number of years required remains obscure.

3.3 A TRIENNIAL CYCLE IN *1 EN* 74:10–16?

We have indicated above (2.2.2) how vv. 9 and 17 in chapter 74 were originally contiguous. The intruding text unit 74:10–16 consists of awkwardly-made calculations of various periods of time, reflecting the time gap accumulated between the schematic year and the lunar year of 354 days. As the variant readings in the Geez mss suggest, these calculations very likely underwent substantial textual modifications.[14] Even disregarding the textual variants, the extant text is far from coherent. We quote the section according to Nickelsburg-VanderKam:

> 10. When five years are added up, the total comes to thirty (extra) days for the sun. All the days that result for one of those five years, when complete, are 364 days.
>
> 11. The extra amount for the sun and stars comes to six days; in five years six (extra) days come to thirty days, and the moon is thirty days less than the sun and the stars.[15]
>
> 12. The moon[16] brings about the years precisely, all according to their eternal positions. They come neither early nor late by one day by which they would change the year: each is exactly 364 days.
>
> 13. In three years there are 1,092 days; in five years there are 1,820 days, with the result that in eight years there are 2,912.
>
> 14. For the moon alone, the days in three years come to 1,062; in five years it is fifty days fewer (*walaʿāmat 5 yaḥaṣṣəs(!) 50 mawāʿəl*).[17]

[14] Thus Neugebauer, “Appendix A,” 399: “It seems pointless to attempt to give an accurate translation of the confused nonsense which some scribes produced from some trivial arithmetic relations.”

[15] This translation must be accepted, despite the fact that it involves a transposition of the word “moon/month,” which is placed later in the sentence in the Geez version.

[16] For this reading, see above, note 13.

[17] While various corrections and changes of the order are considered by the commentators (Charles, Uhlig, Knibb, and more freely Olson, basing himself on ms Tana 9), it is clear that a 10-day gap is posited between the lunar year of 354 days and the 364DY in vv. 13–16 . This gap amounts to 30 days after three years, 50 days after five years, etc. Strangely enough, this calculation is best seen in the group II mss, usually considered to reflect an inferior text of *1 Enoch*, while the earlier and generally better mss—most notably the important ms Tana 9—read the number 1,030

15. In five years there are 1,770 days with the result that in eight years the moon has 2,832 days.

16. For in eight years eighty days are lacking; all the days that it lacks after eight years are eighty days.

Two kinds of schematic years are compared here with the lunar year: the 360-day year and the 364DY. Vv. 10–11 report an annual gap of only six days—i.e., thirty days per 5 years. This calculation is only feasible if the schematic year adopted is the 360-day year, which exceeds the lunar year by exactly six days. According to this calculation, an intercalary lunar month would be necessary every five years. An exception is 10b, which mentions the number 364—but this can be seen as a later, possibly secondary correction. In contrast, vv. 13–16 relate to an annual gap of ten days, reflecting a schematic year of 364 days. A similar gap is reported in 79:3–5, where a gap of five days accumulates over half a year. The short passages 10–11 and 13–16 contradict one another and cannot have existed together in an original unit.[18] Vv. 10–11 in fact constitute the clearest evidence for the presence of the ideal 360-day year in Enochic astronomy, to be added to the evidence previously adduced.[19]

Vv. 13–16 count the gaps accumulated after three, five, and eight years and thus lead to an eight-year intercalation plan. A similar scheme, designed to align the period of eight tropical years with (8 x 12 =) 96 synodic months + three intercalated months of 30 days each,

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instead of 1,062 in v. 14 (reported by Knibb, *The Ethiopic Book of Enoch*, 1:427). This difficult reading is accepted by Isaac: E. Isaac, “1 [Ethiopic Apocalypse of] Enoch,” in *The Old Testament Pseudepigrapha* (ed. J.H. Charlesworth; NY: Doubleday, 1983), 1:54, note r—who nonetheless cannot fully account for it. Although the reading in Tana 9 is accepted by S. Saulnier, “The Date of the Last Supper and Calendrical Variations in Second Temple Judaism” (PhD diss., University of Canterbury, 2006), 26ff, it seems preferable to explain it as a simple scribal mistake (possibly a parablepsis) rather than as a meaningful variant. It is thus incumbent to accept Knibb’s contention that, “In many cases … the original Ethiopic text has survived not in Eth I, but in Eth II manuscripts” (*The Ethiopic Book of Enoch*, 2:35).

[18] O. Neugebauer, *Ethiopic Astronomy and Computus* (ÖAW, philosophisch-historische Klasse, Sitzungsberichte 347; Vienna: ÖAW, 1979), 231, endeavoured to solve this contradiction by suggesting that the 360 days mentioned in vv. 10–11 are not regular 24-hour days but average “days,” equivalent to $^{1}/_{360}$ of the sidereal year. He connects this concept with the Hellenistic “time degrees.” No indication of such abstract time reckoning exists in early Enochic literature, however, while the Ethiopic concept of *kekros* (adduced by Neugebauer, *Ethiopic Astronomy and Computus*, 176f) originates from significantly later literature.

[19] See above 1.3.1.1 and the bibliography cited there; cf. also Cryer, “The 360-Day Calendar Year,” 120–21.

is known in Greek by the term *octaeteris*. Although the invention of this plan is attributed to various Greek astronomers from as early as the sixth century B.C.E., its fullest description occurs in Geminos' *Phenomena* (first century B.C.E.).[20] Since this scheme can only function according to the solar year of 365.25 days, the attempt in 74:10–16 to design an *octaeteris* on the basis of a 364DY was doomed to failure. Neugebauer has claimed that the very endeavour to devise an *octaeteris* cannot be part of an original AB since it confuses the Enochic year with the "Alexandrian" year. It must therefore reflect the efforts of later Greek or Ethiopic authors, similar examples also being found in Ethiopic astronomy.[21] Thus although the *Vorlage* of 74:10–16 no doubt pointed at a cycle longer than one year, it did not refer to a cycle of eight years.

This calculation appears alongside the bold declarations of vv. 12 and 17 on the perfect conduct of the luminaries—particularly the moon—within the schematic year. These are difficult statements indeed, since it is difficult to see how the moon's orbit can be aligned with a 364DY. Being aware of the time gap between the lunar and solar years, the author of AB was trapped between the notion of a schematic year and the problems rising from the actual calculations. This conflict was further aggravated by the move from a 360- to a 364-day year, a transition which accentuated the gaps.

Although both 74:12 and 74:17 speak of the harmonic order of nature, they differ on one crucial point: 74:17 bases the harmony on the ideal 360-day year ("they rise … *for thirty days*"), while 74:12 explicitly mentions the 364DY. According to the author of 74:12, the moon can serve as a model for the 364DY in the same way as the sun and the stars. Why then did this author focus on the moon's role? Firstly, the moon is an important celestial entity which cannot be ignored when seeking to establish celestial harmony. It is also possible, however, that the Enochic author opposed the exclusively solar tendencies prevalent in his time. Albani has demonstrated the apologetic intention of 74:12: The 364-day year is not only suitable as

[20] J. Evans and J. Lennart Berggren, *Geminos's Introduction to the* Phenomena*: A Translation and Study of a Hellenistic Survey of Astronomy* (Princeton and Oxford: Princeton University Press, 2006), 82–87. Cf. Neugebauer, *Ethiopic Astronomy and Computus*, 84; Albani, *Astronomie und Schöpfungsglaube*, 73.

[21] Neugebauer, "Appendix A," 401; idem, *Ethiopic Astronomy and Computus*, 83–88.

a solar year but can also be aligned, with minimal modifications, with the lunar count.[22]

While the EMLV and the Moon Type I and II passages in AB provide a full account of the moon's motion in both Space and Time, the Type III passages 74:10–16 and 79:3–5 make no attempt to explain the moon's spatial aspects or the amount of light it contains. Rather, they seek a merely numerical harmony of sun, moon, and stars over a triennial cycle. Since this concession makes the task of synchronization far easier it was subsequently adopted as the norm in Qumran astronomy.

Albani claimed that the triennial cycle existed in the Aramaic *Vorlage* of AB:

> Diese 30tätige Einheit ist bereits als Zielgröße in 1Hen 74,10.11 ausgemacht worden und auch in 13–16 sind die 3 Jahre mit der gewünscheten Differenz von 30 Tagen der Ausgangspunkt der Berechnungen … Es ist daher anzunehmen, daß in der aramäischen Vorlage am Schluß der synchronistischen Darstellung des Gemeinsamen Laufes von Mond und Sonne durch die Horizonttore (Kurzfassung: 1 Hen 73,1–74,9) einmal von dem dreijährigen Zyklus die Rede war, ein späterer… diese Stelle jedoch als Ansatzpunkt für seine Anspielung auf die Oktateris benutzte.[23]

This claim must be questioned. Although 74:10–11 assumes a 30-day period, this is calculated according to a period of five rather than three years. Furthermore, it is the ten-day gap, which ultimately amounts to fifty or eighty days, rather than the number 30, which constitutes the *Ausgangspunkt* of the calculations in 74:13–16. More importantly, as Albani himself notes, the conceptual mode of AB does not accommodate a cycle longer than one year. While the author was indeed aware of an accumulated gap of thirty days after three years, and probably referred to it in the *Vorlage* of 74:12–16, this did not lead him to create a new operative mechanism for the orbit of the luminaries.

An analogy may be suggested here from the Mesopotamian astronomical models in Mul.Apin, which adhere to schematic 30-day months—i.e., to a 360-day year. By definition, these schemes operate

[22] Albani, *Astronomie und Schöpfungsglaube*, 70–75.
[23] Ibid, 72; cf. also 82.

within a period no longer than one year.[24] In the "Second Intercalation Scheme" of Mul.Apin, however, a three-year intercalation cycle is applied. According to Horowitz, this passage even suggests the number 364 as an average length of the year (Mul.Apin II ii 11–12; see below 4.1.3). This mechanism was never applied in any of the models which together comprise Mul.Apin but remained as a possible correction procedure. Although noting the possibility for correcting the 360-day ideal, the author of Mul.Apin was unable to operate his models according to a more accurate year length, an exercise which would have required a change of the entire paradigm. A similar dilemma is reflected in AB with respect to the triennial cycle. Such a device only became fully operative in later literature, most notably in Qumran.

3.4 The Range of Time Covered in the EMLV

The authors of AB paid considerable attention to the problem of bridging the gap between the 364DY and the lunar 354-day year, the different layers of transmission of the book reflecting the variety of solutions proposed. As long as the difficulty pertained exclusively to the gap in time, it could be easily solved using the triennial cycle—as in the *Vorlage* of 74:10–16. Another aspect of the same problem—the amount of light in the moon throughout the month and the year—was also amenable to a simple solution. The triennial cycle incorporates an additional—thirty-seventh—lunation at the end of three lunar years. In the course of this added month the moon goes through its full cycle, ending the month in the precise status required to open the next lunar cycle.

A graver problem arises in respect to the capacity of the spatial lunar models in AB to account for the triennial cycle. This in fact constitutes an impossible task.[25] Table 2.1, which represents the master plan for the lunar theory of AB, gives the place of the moon in the heavenly gates for any given number of full lunar years. The lunar phases are meticulously calculated so that the moon will end its

[24] See primarily, J. Koch, "Kannte man in Mesopotamien das 364-Tage-Jahr?," *NABU* 1997/119, 109–12.

[25] For this problem, see Albani, *Astronomie und Schöpfungsglaube*, 79; J. Ben-Dov, "The Initial Stages of Lunar Theory at Qumran," *JJS* 54 (2003), 130–31.

annual course at gate 3, ready to begin the next year at gate 4 together with the sun. The addition of a thirty-seventh lunar month interferes with this celestial coordination. Whereas at the end of thirty-six lunations the moon returns to gate 4, after the thirty-seventh lunation it would already have advanced to gate 5! Can the inventor of the triennial cycle have assigned to the moon a month of complete rest every three years? The spatial lunar model in AB is incompatible with the triennial cycle, since at the end of three 364-day years the sun and the moon will not stand together at the same gate. In fact, the texts which convey this model—whether in AB, the EMLV, or Ethiopic astronomical texts—do not employ a triennial cycle but rather function within the framework of a single year.

Not only does the spatial lunar model not support a triennial cycle but the dating system used in EMLV is itself unsuitable for use in such a framework. Let us examine the passage 4Q209 Enastr^{b} 7 ii 6–8, which Milik rightly used to ascertain the method employed in EMLV (his "Synchronistic Calendar"):

6 ובלילא חמשה ועשרין בה כסה שביעין חמשׄה ובציר מנהורה שביעין חמשה

7 ובאדין נפק ואניר בשאר ליליא דן שביעין תרין וקוי ביממא דן שביעין חמשה ופלג

8 ובאדין ערב [ו]עׄל לתׄרעא תנינא וכסה שאר יממא דן שביע חד ופלג

6 And on night twenty-five of this (month) it is covered five sevenths (of night time). And there is subtracted from its light five-sevenths.

7 And then it emerges and shines during the rest of this night, two-sevenths (of night time). And it remains(?) during this day five-and-a-half-sevenths (of daytime).

8 And then it sets [and] enters the second gate and it is covered during the rest of this day one-and-a-half-sevenths (of daytime).[26]

This passage describes the moon's conduct on day 25 of an unspecified month. On this day, the moon begins to rise and set in gate 2 (see line 8). Milik correctly perceived that, according to the table of lunar data (TABLE 2.1), the month discussed in this passage must be the ninth month of the year.[27] The amount of light in the

[26] Quotation according to DJD XXXVI, 145–46, with slight modifications following Drawnel's new interpretation of EMLV.

[27] Milik, *The Books of Enoch*, 283, notes that while the data in the Aramaic fragment do not completely match the data of TABLE 2.1, taken from Ethiopic texts, they do closely correspond.

moon (line 6) corresponds to the twenty-fifth day of the month towards the end of the lunar month. On that day, five-sevenths of the moon's surface are dark, to be completely darkened within four more days. The reference to "night twenty-five" thus clearly alludes to a lunar month.

Let us now reconsider the date of 25/IX. Had the author of EMLV used a 364DY, he should have given the date as 18/IX, since by the ninth month of the year a gap of seven days has already accumulated between the lunar year and the 364DY. This is clearly reflected in 4Q209 7 iii 1–2. In this text, the sun's position at gate 1 indicates that the date in question is the beginning of the tenth schematic month. The EMLV, however, dates it on day 8 of the month, on which four-sevenths of the moon's surface are illuminated. The eight-day gap can only be explained, once again, by the fact that the author used a lunar dating system rather than a schematic one.

The use of lunar dates does not conform to the triennial cycle. For instance, on this scheme how would an author designate days 1–10 in the second lunar year of the cycle? While these days are considered the last ten days of the previous schematic year, they also function as the opening of a new lunar year! And how would such an author designate the days of the added thirty-seventh month, immediately following the ending of three lunar years? In light of these questions, it thus appears that the authors of EMLV and other versions of AB fixed their dates neither according to the 364DY nor the triennial cycle. Had they known how to implement these two schemes in full, they would have dated the astronomical phenomena according to the 364DY—as is the practice in many later Qumran documents.

This conclusion agrees with the nature of the 364DY in AB as discussed above. The author initially sought to achieve a perfect celestial harmony using a single ideal year, with no need of a multi-year cycle. Despite the fact that the necessity for this cycle was acknowledged in 74:10–16 (or its *Vorlage*), the author made no attempt to adjust his astronomical tables and dates to it.

The present discussion suggests a simple solution to the difficult problem raised by Milik when editing the Aramaic fragments of 4Q208 and 4Q209. According to Milik's reconstruction, no less than twenty-seven columns of text in 4Q209 would have been needed to accommodate the detailed description of the lunar phases in the first twelve months. When multiplied by three, this data would demand 81 columns to accommodate the full triennial cycle. Since the dimensions of Qumran scrolls do not allow for such a length of parchment, Milik was compelled to assume that the triennial cycle was only given in the form of a précis.[28] In light of the considerations raised above, however, it is now clear that the EMLV did not exceed the limits of a single year. More specifically, this composition probably never extended beyond the first 354 days—not because the author lacked sufficient space, but because his conceptual model was designed for a single year (serving as a model for all subsequent years). The twenty-seven columns needed for such a text would constitute a perfectly acceptable length.

The use of lunar dating in the EMLV, together with the unresolved difficulties which arise in the spatial lunar model, prove that the concept of the triennial cycle had not yet crystallized in the early stages of the 364-day calendar tradition. While the authors may have been aware of the need for such a cycle, they operated their models along the framework of a single year.

3.5 The Triennial Cycle at Qumran

Since the triennial cycle is already fully developed in many of the calendrical texts from Qumran, it is particularly important to trace the intermediate stages between AB and the calendrical texts in which the triennial cycle was fashioned and developed. This transitional period roughly overlaps with the early stages of the formation of the *yaḥad*, a highly significant period in the history of the scrolls.

3.5.1 *The Absence of the Triennial Cycle from 4Q503 'papDaily Prayers'*

Although the liturgical text preserved in 4Q503 frequently refers to lunar phases, the lunar theory underlying it is not evident, given that this is neither a calendrical or astronomical scroll. The papyrus scroll 4Q503 contains a collection of prayers for the days of an unspecified month. It cites the prayers to be recited at sunset and sunrise (in that

[28] Milik, *The Books of Enoch*, 274–75.

order)[29] of each day of the month, and contains several types of references to the amount of light and darkness in the moon on that specific day. Although the papyrus consists of over 200 fragments, a reliable reconstruction has only been made of several columns. A passage from the reconstructed column VII serves as an illustration:[30]

1 ובצאת֯[השמש]רקיע השמ[י]ם יברכו וענ[ו ואמרו]

2 ברוך א[ל ישראל]ל֯[ ]ו והי֯[ו]ם הזה חד֯ש֯[

3 בארבע[ה עשר שערי אור] לנו ממשל°[

4 עשר דג֯[לי]°וא חום ה[שמש

5 בפוסחו[בכו]ח֯ יד גבורת[ו שלום עליכה]
ישרא֯ל[

6 בחמשה֯[עשר לחודש בע]ר֯ב יברכו וענו [וא]מר֯ו֯ ב֯רוך א[ל ישראל]

7 הסות֯ם֯[ ]ח לפניו בכול מפלג כבודו והלילה[

8 ע]ו֯ל֯ם֯ ולהודות֯ לו֯[ ]פדותנו בראשי֯[ת

9]ת֯סו֯בות כלי אור[ו]ה֯י֯ו֯ם ארבעה ע[שר

10 [גורלות אור] אור הי֯ומם ש[לום עלי]כה ישראל

11 [ ] *vacat* [ ]

12 [ ] ובצאת השמש]להאיר על הארץ יברכו ועו֯[ואמרו]

13 [ברוך אל ישראל א]שר לחגי שמחה ומועדי כ[בוד

14 [ח]משה עשר שער֯[י אור

15 [ ]ב֯גורלות לילה֯[

[29] The fact that sunset constantly precedes sunrise, and in fact marks the onset of every new day, proves that the day begins at sunset rather than at sunrise in this scroll.

[30] The text follows the reconstruction suggested by D. Falk, *Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls* (STDJ 27; Leiden: Brill, 1998), 33. According to F. Schmidt "Le calendrier liturgique des *Prières quotidiennes* (4Q503). En Annexe: L'apport du verso (4Q512) à l'edition de 4Q503," in *Le Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère* [JSJSup112; ed. C. Grappe and J.C. Ingelaere; Leiden: Brill, 2006], 55–87), this reconstruction accords with the material reconstruction of 4Q512 "ritual of purification," written on the verso of 4Q503. Schmidt's study not only considerably improved the material reconstruction of 4Q503 but his reconstruction also solves a number of problems, including those raised by J.M. Baumgarten, "4Q503 (Daily Prayers) and the Lunar Calendar," *RQ* 12 (1987): 399–407 and M.G. Abegg, "Does Anyone Really Know What Time It Is? A Reexamination of 4Q503 in Light of 4Q317," in *The Provo International Conference on the Dead Sea Scrolls* (STDJ 30; ed. D.W. Parry and E. Ulrich; Leiden: Brill, 1999), 396–406.

1 And when [the sun] rises […] the firmament of the heave[n]s, they shall bless. They recit[e, saying:]

2 "Blessed be the Go[d of Israel …]. This d[a]y he renewed […]

3 in four[teen gates of light …] for us dominion […

4 –teen stan[dards …] heat of the [sun …]

5 when he passed over [… by the streng]th of [his] powerful hand [… Peace be on you,] O Israel[…"

6 In the fif[teenth of the month in the ev]ening they shall bless. They shall recite, [s]aying: "Blessed be the Go[d of Israel]

7 who hides […] before him in every division of his glory. This night […

8 [… for]ever and for praising him [for?] our redemption at the begin[ning

9 […] revolutions of the vessels of light. [ ] This day fourte[en]

10 [lots of light …] daylight. Pe[ace be on] you, Israel."

11 *vacat*

12 [And when the sun rises] to shine on the earth, they shall bless. They shall re[cite, saying:]

13 ["Blessed be the God of Israel … (days?) … wh]ich are for the pilgrim festivals of joy and the appointed times of gl[ory]

14 [… f]ifteen gate[s of light …]

15 […] in the lots of the night […"]

Although 4Q503 preserves fragmentary references to several of the days numbered 4–28 within the month, unfortunately no reference to the beginning or end of the month is extant. The use of the root פסח in the benediction of VII 5—"When he passed over"—clearly refers to the festival of Pessah, linking this passage to days 14–15 of month I. The prayers contained in this scroll are consequently meant neither for every month of the year nor for the festivals of the seventh month (as once suggested), but rather only for the first month.[31]

[31] Thus recently D. Nahman, "When Were the 'Daily Prayers' (4Q503) Said in Qumran?," *Shnaton* 13 (2002), 178–81 (Hebrew); Schmidt, "Le calendrier liturgique," 62.

Since the style and vocabulary of the scroll are not unequivocally sectarian, scholars have debated whether it belonged to *yaḥad* circles or reflects more general Jewish ideas.[32] Pertinent to this question is the fact that 4Q503 links dates within the month to days of the week, with Sabbaths fixed on days 4, 11, 18, and 25 (see above 1.4.5). The beginning of the month falls on the fourth day of the week, a distinctive trait of the 364DY.[33] Despite not being completely formulated in characteristic Qumran style, 4Q503 can therefore be identified as belonging to the 364DCT.

In column VII quoted above, the combination of the date in line 6 with the enumeration of the parts of light in lines 3, 9–10 allows for a reconstruction of the terminology employed. 4Q503 uses three terms denoting an astronomical function: שערי אור "gates of light," גורלות אור/חושך "lots of light/darkness," and דגלי אור/לילה "standards of light/night." The very few extant attestations of these terms in 4Q503 permit the following discussion.

The number of the "gates of light" per day is equivalent to that day's serial number within the month. Thus, on day 14 of the month, fourteen gates are counted (VII 3), on day 15 fifteen gates (VII 14), and on day 25 twenty-five gates (XII 19–20).[34] This count of gates does not correspond to the heavenly gates of *1 Enoch* 72, since in that source the sun traverses a single gate throughout the first month. It would thus appear that in 4Q503 each daily exit of the sun is counted as one "gate."[35]

[32] Baumgarten, "4Q503," 402; E. Chazon, "The Function of the Qumran Prayer Texts: An Analysis of the Daily Prayers (4Q503)," in *The Dead Sea Scrolls: Fifty Years After their Discovery 1947–1997. Proceedings of the Jerusalem Congress, July 20–25, 1997* (ed. L.H. Schiffman et al.; Jerusalem: Israel Exploration Society, 2000), 217–25; Falk, *Daily, Sabbath, and Festival Prayers in the Dead Sea Scrolls*, 22; Schmidt, "Le calendrier liturgique," 71–72.

[33] Nahman, "4Q503," 179–80; Schmidt, "Le calendrier liturgique," 59f.

[34] For the latter, see Baillet, DJD VII, 118. The reconstruction is based on line 12 of the same fragment, which reads ו̇ביום ששה ו[עשרים, "and on the [twenty-]sixth day." For other gate counts, cf. frgs. 19 and 35.

[35] Schmidt, "Le calendrier liturgique," 67, suggested somewhat differently that the central gate 4, close to the equinox, is divided into thirty smaller gates which correspond to those mentioned in 4Q503. He further proposed that each of these small gates is designated by the Aramaic term חרת (4Q209 7 iii 2 and 5). If this is correct, however, one would expect to find the Hebrew equivalent of חרת in 4Q503—instead of the general term שער. Further, Schmidt's explanation fails to account for the use of the same term in 4Q209 8 4, which describes a different occasion, in a different month, and a distinct heavenly gate.

The "lots" of light and darkness correspond to the "parts" of lunar light mentioned in AB. The reason for the difference in terminology lies in the poetic character of 4Q503, which employed more elegant and expressive terms than those used in AB.[36] Numbers of lots are extant in III 21 חמש]ה גור[ל]ות אור, "fiv[e lo]t[s of light,"[37] and somewhat better preserved in frg. 39 שלושה עש֯]ר]גורלות חושך, "thirtee[n] lots of darkness."[38] These two references correspond to days 6 and 28 of the month respectively. We may consequently infer that lots of light are counted during the first part of the month, as the moon waxes, being replaced with lots of darkness during the second part of the month.[39] In 4Q503, the full moon is reached on day 15 of the month. In agreement with AB, the full moon consists of fourteen parts/lots of light which decrease daily by one part of light—or conversely gain one part of darkness daily from day 16 onwards. On day 28, the moon will therefore count thirteen parts of darkness, as specified in frg. 39.

The ordinal number of the day in the month is larger by one than the number of illuminated parts of light. The reason for this may lie in the fact that in 4Q503 the month does not begin with first visibility but already with conjunction, on the day prior to first visibility.[40] On that day, no parts of lunar light can yet be seen, the moon being too close to the sun. Caution should be exercised here, however, since, most unfortunately, no trace is left of the description of day 1. Schmidt has also pointed out that "le premier croissant n'apparaît que le lendemain, le 2 du premier mois"—but he prefers assigning one half-part of light (i.e., $^{1}/_{28}$ of the moon's light) to day 1 rather than complete darkness.[41]

[36] The term גורלות אור, "lots of light," also appears in 4Q440 1 2.

[37] Baillet, DJD VII, 106. According to Falk's reconstruction, frgs. 4–6 also belong to column III. An additional reconstruction of the number of lots is possible in the description of day 13 (DJD VII, 110; col. VI, frg. 16), where the number twelve appears in line 15.

[38] This night is especially marked by the interlinear note הואה ל֯י֯ל֯ת֯ ה֯[, "this is the night of[" (Baillet, DJD VII, 119). The content of this note is unfortunately broken off and its reading is far from certain, most notably the *taw*.

[39] Cf. Abegg, "Does Anyone Really Know What Time It Is?," 399; Schmidt, "Le calendrier liturgique," 59.

[40] Cf. M.O. Wise, "Second Thoughts on *dwq* and the Synchronistic Calendar," in *Pursuing the Text: Studies in Honour of Ben Zion Wacholder on the Occasion of his Seventieth Birthday* (JSOTSup 184; ed. J.C. Reeves and J. Kampen; Sheffield: Academic Press, 1994), 101 and n. 13; DJD XXI, 33–34.

[41] Schmidt, "Le calendrier liturgique," 65–66.

The doubt with regard to the amount of light in the moon during the first day of a full month is due to a conceptual problem, expressed also in the various readings of *1 En* 73:7 (see the *Excursus* in 2.2.1, with references to 4Q503 and 4Q317). While according to the primary reading of *1 En* 73:7, one part of $^{1}/_{14}$ was illuminated on day 1 of the month, secondary readings of that verse count only $^{1}/_{28}$ of the moon's light on day 1, thus endorsing Schmidt's view. This secondary reading should not be adopted as the solution to the problem in 4Q503, however. Overall, 4Q503 displays similar concepts and conflicts to those of AB and its related literature, thereby revealing its reliance on the latter text.

The last term to be resolved is that of the דגלים, "standards" or "divisions."[42] Here the evidence is even scantier. "Standards of light" (דגלי אור) are mentioned in frg. 10, while "standards of night" (דגלי לילה) appear in frgs. 30 and 32 (column VIII).[43] Neither of these references count the standards mentioned in them. Frg. 10 relates to day 9 of the month (cf. היומם תשעה in line 3), while frgs. 30–32 probably correspond to days 16 and 17.[44] It is possible that, in similar fashion to the "lots," the notations vary from the first to the second part of the month. Of the two terms, the lots are more numerically concrete, the standards appearing as general statements on light and darkness: standards of light are a general indication of daytime, those of darkness of night time.

Having clarified the terminology of 4Q503, we may now return to the question of the relation between the lunar phases and the schematic calendar of 364 days in 4Q503. The fact that this text only covers the first month of a year makes it difficult to reach a conclusion, during that month no gap having yet accumulated between the lunar and the schematic count. Although such a gap would have been discerned had a description of the end of the month been preserved, the extant fragments unfortunately do not exceed day 28. The fact that lunar phases are mentioned in 4Q503 does not constitute

[42] This term is used in a technical sense in the Aramaic of *1 Enoch* 2: see Milik, *The Books of Enoch*, 146ff.

[43] In frg. 54 2, Baillet reads דקלי א֯ו֯]ר (the word דקלי being a phonetic variant of דגלי). However, of the last two letters only the lower tips have survived, and these can equally support the reading ח֯ו֯]שך. Furthermore, it is difficult to determine to which part of the month frg. 54 belongs.

[44] DJD VII 112–113; Abegg, "Does Anyone Really Know What Time It Is?," 400; Schmidt, "Le calendrier liturgique," 84–85.

proof that the scroll used a lunar calendar (*pace* Baumgarten).[45] On the contrary, the scroll displays strong affinities with the schematic year in fixing the dates of Sabbaths within the month—a process which a strictly lunar calendar could not have supported. While Baumgarten's assertion that lunar phases are employed in 4Q503 with respect to religious-liturgical events is correct, the fundamental component of the composition undoubtedly lies in the schematic day count within the month. The ordering of the prayers does not follow the lunar phases but the number of days in the schematic month. It is also instructive to note that the sun is mentioned recurrently in 4Q503—twice every day—whereas the moon is never referred to.[46] There can therefore be no doubt that 4Q503 functions according to the schematic 364DY.

It should now be asked whether 4Q503's schematic time reckoning is based on a single schematic year or on a triennial cycle, as in other Qumran calendars. The conclusion reached earlier in this chapter indicates that the EMLV did not employ the triennial cycle, and that the Geez AB, although hinting at such a cycle, did not fully implement it. What then is the case with regard to 4Q503?

4Q503 correlates the days of the schematic month not only with the weekly days but also with the lunar phases. If the author was employing a triennial cycle, such a correlation could only have functioned in the first year of the triennial cycle, being disturbed by the accumulated yearly gap of ten days in the second and third years. According to the Qumran triennial cycle, the prayers of 4Q503 could therefore only be used at the beginning of every new cycle. David Nahman has suggested that this was indeed the scroll's intention.[47]

[45] Baumgarten, "4Q503," 405, concluded that "In 4Q503 the liturgical application is saliently emphasized, with each phase of the moon accompanied by an appropriate blessing"; cf. also R.T. Beckwith, *Calendar and Chronology, Jewish and Christian: Biblical, Intertestamental and Patristic Studies* (AGAJU 33; Leiden: Brill, 1996), 114; S. Stern, "Qumran Calendars: Theory and Practice," in *The Dead Sea Scrolls in Their Historical Context* (ed. T. Lim et al.; Edinburgh: T&T Clark, 2000), 182.

[46] Cf. U. Glessmer, "Calendars in the Dead Sea Scrolls," in *The Dead Sea Scrolls After Fifty Years* (ed. P.W. Flint and J.C. VanderKam; Leiden: Brill, 1999), 2:254.

[47] Nahman, "4Q503," 180. In support of Nahman's argument one may add that 4Q319 records an אות on precisely the same occasion, namely at the beginning of every new triennial cycle. It is therefore possible that 4Q503 is the liturgical implementation of 4Q319; the term אות appears in 4Q503 frgs. 54 and 64. However, the fact that priestly courses are never mentioned in 4Q503 militates against this hypothesis, the priestly courses constituting an integral part of the triennial cycle in 4Q319.

The absence of any reference to a "first year"—and equally to a second or third year, or to any other element of the triennial cycle—makes this idea difficult to accept, however. Having concluded that 4Q503 was designed to cover the days of one month, it would appear that the prayers were recited as a yearly event every time such a month occurred. In similar fashion to the EMLV, the author of 4Q503 was not yet aware of the full scheme of the triennial cycle and was either incapable of, or uninterested in, assigning detailed dates and days of the week over three whole years. He rather worked with a single 364DY.

4Q503 thus differs markedly from such scrolls as 4Q317 and 4Q321, and efforts to correlate the two types of calendrical texts appear futile.[48] A similar conclusion was reached by Schmidt, who has demonstrated that the lunar data of 4Q503 do not correspond to those of 4Q321.[49] Although the author of 4Q503 takes pains to correlate yearly dates with the Sabbaths and weekly days, the scroll does not display the traits of the Qumran calendars proper. This may attest to a relatively early authorship of the composition it contains.[50] Alternatively, the difference may be explained in relation to distinctions of genre: elaborate calendrical lists of dates and *mišmarot* are given only in calendar texts, while liturgical texts confine themselves to a general outline of a single schematic year.

3.5.2 *The Lunar Cycle in 4Q334 Ordo*

Like 4Q503, the fragmentary scroll 4Q334 Ordo links liturgical compositions to the days of the month.[51] This scroll counts prayers to be recited every day, distinguishing daytime from night-time prayers. It also distinguishes two genres of prayers: שירות "songs" and דברי תשבחות "words of praises," the latter significantly changing in number during the course of the month. Nebe has quite plausibly suggested that the number of "words of praises" increases by two every day and

48 This effort was undertaken by Abegg, "Does Anyone Really Know What Time It Is?"

49 Schmidt, "Le calendrier liturgique," 68–70.

50 Thus R.T. Beckwith, "The Essene Calendar and the Moon: A Reconsideration," *RQ* 15 (1991/92), 461. The script of 4Q503, however, is not dated particularly early with regard to the calendrical texts—the beginning of the first century B.C.E.

51 U. Glessmer, "334. 4QOrdo," DJD XXI, 167–94.

concomitantly decreases by two every night.[52] According to his reconstruction, at the beginning of the month sixty "words of praises" are recited at night and no such words during the day, the reverse circumstance obtaining at the end of the month. The tentatively reconstructed month in 4Q334 thus lasts thirty days.

While the preservation of the text does not allow for concrete reconstructions, Nebe's notion can be reasonably adopted as an interpretative framework. Another advantage of his interpretation lies in the fact that the contrasting numbers of prayers for day and night resemble other systems—such as those in 4Q503 and the EMLV—which express the ratio of light and darkness in the moon.

In DJD XXI, Glessmer rejected Nebe's reconstruction.[53] While Nebe assumed that the month began at new moon, Glessmer contended, on the basis of his interpretation of *dwq* in 4Q320 and 4Q321, that lunations at Qumran were reckoned from the full moon. Not only is the full-moon commencement of the month far from conclusive (see below 5.3.5), however, but no reason exists to assume that all lunar texts employ the same system. On the contrary, it would appear that whereas 4Q334, following 4Q503, is patterned according to the models of AB, the calendrical texts proper follow a slightly different system. Nebe's reconstruction of 4Q334 as a liturgical text related to the lunar month, tentative as it is, should consequently be accepted.

3.5.3 *The Triennial Cycle in 4Q317*

3.5.3.1 *Notes on the Structure of 4Q317*

Although 4Q317 has not yet been formally published, several transcriptions of it are available, the best so far being Martin Abegg's.[54] The order of the fragments is problematic, as are the numerical notations in the scroll, which are replete with mistakes,

[52] G.W. Nebe, "Qumranica II: Zu unveröffentlichten Handschriften aus Höhle 4 von Qumran," *ZAH* 10 (1997): 135–38.

[53] DJD XXI, 179.

[54] For a partial and preliminary publication, see Milik, *The Books of Enoch*, 68. Photos are available in DJD XXVIII, plates LII–LVIII. The latest transcription is by M. Abegg, *DSSR* 4, 58–71. Additional notes on Abegg's transcription follow below. For a discussion of 4Q317, see also Glessmer, "Calendars in the Qumran Scrolls," 261f.

corrections, and interlinear insertions. At the same time, the formulaic style makes it possible to reconstruct long sections of text. Abegg has reconstructed several passages sufficiently to warrant the following discussion. An example is 4Q317 1 + 1a ii:

7 בשמנה֯[55] בו ת֯[משול אורה ליום בתוך]

8 הרקיע ממע֯[ל ארבע עשרא וחצי ובבוא השמש יכלה כול[56]]

9 אורה להכס֯ות֯ [וכן יחל להגלות]

10 באחד לשבת *vacat* [...

7 On the eighth (day) in it (= the month), [its light (= the moon's light)] ru[les all the day in the midst]

8 Of the firmament abov[e fourteen-and-one-half parts. And when the sun sets,] its light [ceases]

9 to be obscured, [and thus it (= the moon) begins to be revealed]

10 on the first day of the week *vacat* […

This passage is part of a lengthy account of the moon's waning, day after day, one part daily, until all fourteen parts remain dark. Alternatively, according to a corrective hand, fourteen and one half parts are obscured or lit at the syzygies. On the eighth day of an unspecified month—which is also the first day of the week—the moon is totally obscured. The author recounts how the empty moon "rules" the sky throughout that day and begins to be revealed at sunset. This description agrees with the order of events at the beginning of the lunation.

Despite the absence of the phrases "first/ second/ third year" from 4Q317, at least two good indicators suggest that this scroll did employ a triennial cycle.

1. The dates used in 4Q317 are schematic dates in the 364DY rather than lunar dates. This is evident from the dating of the new moon (or the day of conjunction) on the eighth day of the month

[55] F. García Martínez and E.J.C. Tigchelaar, *The Dead Sea Scrolls Study Edition* (Leiden: Brill, 1998), 672, read here two superlinear letters, pointing at a correction: בש{בע}מנה. Since the photos in DJD XXVIII do not attest any writing in that location, however, the reading "eight" is certain.

[56] Milik, followed by García Martínez and Tigchelaar, reconstructed יהיה instead of יכלה כול here. This reconstruction is based on the reading יה]יה in 4Q317 2 28 (*olim* frg. 3 line 8). Since the latter word is not attested in the photos of frg. 2, the reconstruction יכלה כול should be adopted, following Abegg.

in the passage quoted above, which would be impossible either in a lunar calendar or in a single 364DY. In this aspect, therefore, 4Q317 more closely resembles the Qumran calendars than the Enochic AB.

2. The span of time covered in 4Q317 can be assessed by tracing the amplitude of the dates of the new moons given in the scroll. During a single schematic year, the date of new moon in each of the schematic months will recede by a maximum of ten days. In 4Q317, the new moon appears to wander substantially more than this. The point of departure for this calculation is frg. 1 ii quoted above, where the new moon occurs on the eighth day of the month. Other dates are as follows:[57]

(a) In frg. 3 32,[58] García Martínez and Tigchelaar read בעשרים] ו]אחד בו תמשול ... "[on the twenty-]first in it it rules …" This implies that the new moon is dated to the twenty-first day of the month. This reconstruction is not certain, however. It should also be noted that Abegg did not reconstruct any of the day numbers in this fragment.[59]

(b) In frg. 10, the waning of the moon covers at least five consecutive days, numbered "20 + X," with the units no longer extant. The date of the new moon is not preserved. It could have occurred on day 20 + X, but possibly also at the beginning of the next schematic month.

[57] In a previous publication, I suggested proof (a) below, based on the reading by García Martínez and Tigchelaar: Ben-Dov, "The Initial Stages of Lunar Theory," 132. When collated, however, this reading proved erroneous. I therefore had to adduce additional evidence for the same conclusion.

[58] The numbering follows the plates in DJD XXVIII and Abegg's edition; in the *Study Edition* the passage is frg. 4 line 8.

[59] At the beginning of the line, before the word בו, two letters are clearly seen. Abegg noted their existence but was unable to identify them, thus missing an important clue. García Martínez and Tigchelaar read them as three (!) letters, being part of the number עשרים ו]אחד. In 4Q317, however, the units always precede the word for twenty: אחד ועשרים, שלוש ועשרים, etc. Additional elements not reconstructed by Abegg in frg. 32 include: 1) the broken letters at the beginning of line 29, previously read as בשמונה עש]ר בו]; and 2) in line 31 בעשרי]ם בו]. While the latter is inconclusive because the letter *mem* cannot be seen in the photos, the former of these two readings is quite plausible.

(c) Stronger evidence comes from frg. 22, where the last day of waning (line 3) is recorded in very close proximity to the number twenty (line 1), placing the new moon in the last part of the schematic month:

1]ועשרים

2]○ בו תכ̊]סה

3]בׄו תמ]שול אורה ליום

1 X] and twen[ty

2] in it (its light) co[vers

3] in it [its light] ru[les the day

The data collected thus far proves that the new moon "wanders" back and forth along the schematic month for at least thirteen days, between the eighth day (frg. 1), the twenty-first day (frg. 22), and possibly also later (frg. 10).[60] Such amplitude cannot take place within the limit of a single schematic year, in which a gap from the lunar year of only ten days exists. 4Q317 therefore inevitably involves a period longer than one year, the triennial cycle constituting the most plausible possibility.

It is now appropriate to calculate the space required in order to describe three years of lunar data according to the method employed in 4Q317.[61] The maximum preserved height of a column appears on frgs. 1+1a ii. This column contains the lunar phases for 22 days (from day 4 to day 25) of an unspecified month. 16.5 columns would thus have been needed to describe the course of one year, and around 50 columns for a triennial cycle. The full width of a column appears in frg. 2, where the length of the entire line was approximately 9 cm. The intercolumn margin in frgs. 1+1a measures 2.25 cm on average. The width of a column + margin is therefore 11.25 cm. These calculations yield the following results:

[60] The data adduced thus far pertain only to the wandering of the new moon, while the amplitude preserved for the full moon is not as great. In 1+1a 27, a full moon occurs on day 21 or 22 of the month, while in 7 ii it occurs on day 13. Seven or eight days of difference do not constitute sufficient proof for our purposes, since they do not exceed the ten-day gap accumulated in one year.

[61] A similar calculation conducted by Milik regarding 4Q209 concluded that it would require 27 columns to describe the observations pertaining to one year only (see above 3.4).

For one year: 11.25 x 17 = 191.25 cm

For three years: 11.25 x 50 = 562.5 cm

The description of one year thus demands a 191cm-long scroll and approximately six meters for the course of three years (562 cm + an empty sheet). A six-meter long scroll is not extraordinary according to the standards of the DSS. According to the data collected by Emanuel Tov, this scroll would rate thirteenth or fourteenth in the list of longest scrolls—far shorter than such scrolls as 11QT[a] or 1QIsa[a].[62] It is thus both technically possible and contextually probable that 4Q317 covered a span of three years.

It appears that the author of 4Q317 was compelled—maybe for the first time—to acknowledge that a single schematic year cannot provide a sufficient explanation for the orbits of the luminaries. In 4Q317, the triennial cycle was first transformed from an abstract arithmetic figure to a detailed technical model. 4Q317 thus paved the way for the use of the triennial cycle in the *mišmarot* scrolls.

3.5.3.2 *The Moon in 4Q317 and the EMLV: A Comparison*

The two lunar texts of the EMLV and 4Q317 share much in common, the latter document being dependent upon the basic system of the former. In effect, 4Q317 may be said to constitute a variation on the EMLV in the same fashion as parts of AB form a variant on the same theme. The conclusions drawn above with regard to the composition of AB may consequently be helpful in endeavouring to characterise the nature of 4Q317.

In the previous chapter we indicated how AB separates the categories of Space and Time, addressing each in discrete textual passages. This conceptual mode is even more marked in 4Q317, where the spatial aspect of the moon's orbit, represented by the heavenly gates, is completely neglected in favour of a discussion of lunar visibility. This fact removes 4Q317 even further from astronomical reality than AB. In essence, 4Q317 is a purely schematic treatise which possesses no bearing on empirical observations of the moon.[63] This circumstance is inherently linked to the fact that this

[62] E. Tov, "The Dimensions of the Qumran Scrolls," *DSD* 5 (1998), 71–73.

[63] I do not concur with the attempts of J.-C. Dubs to demonstrate the practical utility of 4Q317 in maintaining lunar models: J.-C. Dubs, "4Q317 et le role de l'observation de la Pleine Lune pour la determination du temps à Qumrân," in *Le*

scroll constitutes the first text in which the triennial cycle is adopted. The calculations of the triennial cycle would not have been possible had the author also wished to account for the heavenly gates. In contrast to *1 En* 74:10–16, where the triennial cycle takes the form of a vague ideal, the present author takes pains to record the actual phases of the moon day by day for three years. In the absence of any spatial considerations, the roster in 4Q317 appears extremely simplistic. This style was deliberately adopted by the author, who sought to demonstrate how the triennial cycle was applicable. It was, indeed, this method of recording lunar phases which gained particular prominence in later *yaḥad* compositions.

3.5.3.3 *4Q317 as a Sectarian Document*

A further disparity between 4Q317 and AB, as yet unnoted, pertains to the importance of the days of the week (see above 1.4.5). Although aware of the number 364, the Enochic text never notes the days of the week. This is due to the fact that AB originally adopted the model of a 360-day year—in which the days of the week and other septenary traits are irrelevant. In 4Q317, however, the celestial phenomena are conspicuously tied to weekdays. This connection is laid out explicitly in the following examples:

Frg. 1+1a ii 10 באחד לשבת

Frg. 9 11 לשבׄתׄ

Frg. 2 29 and frg. 4 32 בארבעה לשבת

4Q317 thus not only merged the 364DY into longer time units but also defined the subunits of this year, especially the days of the week. Such a linkage of the annual course with the weekdays is an important characteristic of Qumran calendars. In this respect, 4Q317 demonstrates close affinities with the sectarian calendar scrolls. This conclusion finds support from the language and script of the scroll. While the Enochic AB was written in Aramaic, the author of 4Q317 elected to write in Hebrew. The preference for Hebrew in sectarian

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Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère (ed. C. Grappe and J.-C. Ingelaere; JSJSup 112; Leiden: Brill, 2006), 37–54. Dubs' hypothesis rests on the concordance between a certain month in 4Q317 and actual observations of the moon. The applicability of 4Q317 must be demonstrated not for a single month but for the entire cycle, however, and in this respect 4Q317 is significantly off target.

texts is usually explained in terms of the identity of the *yaḥad*, a group which deliberately opposed the prevalent linguistic customs in order to sanctify the ancient, sacred Hebrew language.[64] The Hebrew composition on lunar phases may constitute part of this tendency.

Finally, the fact that the scroll bearing the single copy of this astronomical composition was encrypted using the crypticA script points clearly towards a sectarian background of some kind. The encryption was carried out in order to prevent access to the encrypted material by the uninitiated—probably also including most of the community's members. Following Milik, Stephen Pfann surmises that cryptA was designed for the exclusive use of the *maskil*.[65] It is significant in this respect that other calendrical and semi-scientific literature in Hebrew from Qumran—such as the calendrical texts 4Q324d–i and the physiognomic-astrological text 4Q186—was also encrypted or otherwise veiled. The practice of confining scientific texts to the eyes of the initiated is well attested in scientific and divinatory texts from Mesopotamia.[66] It therefore appears that the achievements of the Jewish calendrical-astronomical discipline were so highly appreciated that they were restricted to the perusal of properly-initiated scholars. Eventually, texts such as 4Q317 exerted a significant influence on the formation of calendars within sectarian circles.

[64] See S. Weitzman, "Why Did the Qumran Community Write in Hebrew?," *JAOS* 119 (1999): 35–45; W.M. Schniedewind, "Qumran Hebrew as an Antilanguage," *JBL* 118 (1999): 235–52, esp. 242–44; H. Eshel, "Hebrew in Economic Documents from the Judean Desert," *Lešonénu* 63 (2000/2001): 41–52 (Hebrew), with additional bibliography cited in n. 44.

[65] S. Pfann, "The Writings in Esoteric Scripts from Qumran," in *The Dead Sea Scrolls Fifty Years After Their Discovery: Proceedings of the Jerusalem Conference, July 1997* (ed. by L.H. Schiffman, E. Tov, and J. VanderKam; Jerusalem: Israel Exploration Society, 2000), 178.

[66] Concealment phrases are common in ACT texts as well as in other scientific and divinatory literature: see Neugebauer, ACT, 1:12; M. Popović, "Physiognomic Knowledge in Qumran and Babylonia: Form, Interdisciplinarity, and Secrecy," *DSD* 13 (2006): 150–76, esp. 166–76; A. Lenzi, "The Secrets of the Gods and Society: Studies in the Origins, Guarding and Disclosure of Secret Knowledge in Ancient Mesopotamia and Biblical Israel" (PhD Diss., Brandeis University, 2006).

3.5.4 *The Triennial Cycle and Lunar Phenomena in* Mišmarot *Scrolls*

The final stage in the development of the triennial cycle appears routinely in various calendrical scrolls from Qumran. We shall examine this stage in broadly terms here, the details being discussed in Chapter 5.

Several calendrical scrolls—4Q319, 4Q320, 4Q321, 4Q321a—involve a synchronization of the solar and lunar orbits according to the triennial cycle. Except for the fragmentary 4Q321a, all these texts in fact constitute compendia of various calendrical rosters—festival calendars, mnemotechnical lists of month-lengths, *otot*, and short literary passages framing the various lists. This indicates that the recording of lunar phases was considered an integral part of Qumran calendrical wisdom.

The sexennial *mišmarot* cycle comprises two shorter cycles of three years each, corresponding to the luni-solar triennial cycle. The *mišmarot* documents are therefore by definition related to the lunar phases. The *otot* section in 4Q319 sanctifies the beginning of every new triennial cycle by proclaiming an *ot* every three years when, according to the ideal schemes, the sun and moon were due to be in conjunction, thereby reenacting the divine order assigned to the luminaries at Creation. 4Q320 and 4Q321 also mark key dates in the course of each lunation along the triennial cycles, 37 lunations altogether. The precise astronomical significance of these events aside, it is evident that whoever wrote and consulted the documents held the place of lunar phenomena within the calendar reckoning in high regard. This fact was noted long ago by Beckwith, who also argued that the true characteristic of the sectarian calendar was not its solar (thus also anti-lunar) tendency but its schematic aspect and predictability, which contrasted with the *ad hoc* determination of the rabbinic calendar.[67]

Talmon and Knohl, who first published the *mišmarot* texts, claimed that the lunar events recorded there belong to the waning phases of the moon, the sectarian author intending thereby to exemplify the moon's

[67] Beckwith, "The Essene Calendar and the Moon," 459; R. Elior, *The Three Temples: On the Emergence of Jewish Mysticism* (trans. by D. Louvish; Oxford: Littman Library of Jewish Civilization, 2004), 206, 219–26.

weaknesses as part of an anti-lunar polemic.[68] Although Talmon and Knohl's identification of these two lunar phases is supported below by further evidence, the motivation for the composition of 4Q320 and 4Q321 they proposed is no longer tenable. Numerous other calendrical texts from Qumran demonstrate the fact that the calendar computations are incomplete without consideration of lunar phenomena. The moon is not mentioned pejoratively but constitutes an essential component of the natural march of Time. Other lunar texts from Qumran—4Q317, 4Q318, 4Q503, as well as the various copies of AB—employ lunar reckoning as a matter of course. It is unlikely that all these texts record the lunar orbit merely in order to condemn it.

While the sectarian authors of the *mišmarot* scrolls determined their cultic year solely on the basis of the 364DY, they took pains to synchronize this calendar with the lunar orbit, albeit in a highly schematic way, far removed from actual reality. The authors felt no compunction to either justify their view or append an evaluative statement concerning the moon.

3.6 Theological Statements Concerning the Moon and its Orbit in the Early Stages of the 364DCT

The Qumran literature—both pre-sectarian and sectarian—displays a special interest in lunar phases and their synchronization with the 364DY. This tendency was fashioned gradually, as the calendar tradition developed. Whereas earlier compositions attest to conflicts with regard to the moon's role, later texts include the moon in their calculations without further justification. Below, we shall attempt to reconcile what appears to constitute a contradiction between the two types of sources. Only those texts which belong within the 364DCT will be discussed, leaving *Sir* 43:6–7 aside, despite the fact that this source is roughly contemporaneous with the (proto-)sectarian sources discussed here.

[68] S. Talmon and I. Knohl, "A Calendrical Scroll from a Qumran Cave: *Mišmarot B*[a], 4Q321," in *Pomegranates and Golden Bells: Studies in Biblical, Jewish, and Near Eastern Ritual, Law, and Literature in Honor of Jacob Milgrom* (ed. D.P. Wright, D. N. Freedman, and A. Hurvitz; Winona Lake, IN: Eisenbrauns, 1995), 298–301.

The earliest statements in the debate are found in *1 En* 74:12, 17, already discussed above, where the moon, sun, and stars are all considered representative markers of the course of Time. In 74:12, the author declares that even the moon can be reconciled with the 364DY—*baṣədq ṭənquq* "in true justice."[69]

The failure of AB to achieve a complete concordance between sun and moon is referred to in *Jub* 6:36:

> There will be people who carefully observe the moon with lunar observations (*yāstaḥayyəṣu warḫa baḥuyāṣe warḫa*) because it is corrupt (with respect to) the seasons and is early from year to year by ten days.

Who are these individuals "who carefully observe the moon" whom *Jubilees* so fiercely opposes? The Geez verb *ʾastaḥāyaṣa* implies systematic rather than random observation. It is commonly assumed that the verse refers to the luni-solar calendar, which later became the foundation for the rabbinic calendrical system.[70] *Jubilees* is not only relevant to the proto-rabbinic calendar, however. Its author was also fully aware of AB and its calendrical calculations (cf. *Jub* 4:17)[71] and was unable to ignore the lunar system suggested there. Albani and Glessmer have in fact suggested that the polemics of *Jub* 6:36 address not only the luni-solar calendar but also the lunar models of AB.[72]

The author's complaint that the moon "is corrupt (with respect to) the seasons" reveals that he was not content with the temporal model offered in AB for luni-solar synchronization but was seeking an eternally-valid method which was in no need of correction or intercalation. In the eyes of the author, the main virtue of the 364DY lay in its everlasting applicability—and in this respect he opposed the models of AB as much as he did the luni-solar rabbinic calendar. Having found flaws in the lunar computus of AB, the author of *Jubilees* dismisses the role of the moon altogether.

[69] For this phrase, see Uhlig, *Das äthiopische Henochbuch*, 649. Other commentators consider it a doublet and omit one of the words.

[70] E.g., S. Talmon, *The World of Qumran from Within: Collected Studies* (Jerusalem/Leiden: Magnes/Brill, 1989), 166.

[71] See J.C. VanderKam, *From Revelation to Canon: Studies in the Hebrew Bible and Second Temple Literature* (JSJSup 62; Leiden: Brill, 2000), 313f.

[72] Albani, *Astronomie und Schöpfungsglaube*, 87; U. Glessmer, "Explizite Aussagen über kalendarische Konflikte in Jubiläenbuch: Jub 6,22–32.33–38," in *Studies in the Book of Jubilees* (ed. M. Albani, J. Frey, and A. Lange; Tübingen: Mohr Siebeck, 1996), 150–51.

The discussion thus far has produced two kinds of statements. In the Enochic AB, the moon is accepted as a legitimate calendrical marker with regard to both Time and Space; in *Jubilees* the moon is rejected outright. The importance of 4Q317 must be understood against this background. 4Q317 represents an intricate mediating position. On the one hand, its author disregarded the spatial aspect of the moon's orbit in the synchronization scheme. On the other, the demarcation of the temporal aspect of the moon's orbit was significantly enhanced by the development of the triennial cycle in 4Q317, which up until then had merely constituted a preliminary insight. The encrypted message of 4Q317 was intended to allow consideration of the moon when devising the religious calendar. The author of 4Q317 would have surely agreed with *1 En* 74:12 that "the moon brings about the years precisely."

The three sources discussed in the present chapter preceded the formation of the bulk of sectarian literature. AB is certainly early, and *Jubilees* is usually considered a pre-sectarian work—or at least as representative of the early stages of the formation of the *yaḥad*.[73] 4Q317 has been dated by Carbon-14 tests to the mid-second century B.C.E.[74] It would therefore appear that around the mid-second century B.C.E. a conflict arose between calendar experts within the 364DCT concerning the due place of lunar observations. Against the extremist views expressed in *Jubilees*, the early sectarian author of 4Q317 settled the controversy by adopting an intermediate position, subsequently accepted as the norm by the *yaḥad*. While lunar phenomena were taken into account in calendar reckoning, they were recognised in order to synchronize them with the 364DY.

The resulting consensus led to a situation in which the observation of the moon no longer constituted an issue in the Qumran calendrical discipline—a fact which contributed in its turn to the detachment of this discipline from empirical observations. The moon was no longer considered to be a physical object which moves in a complex orbit in the sky, but a "theoretical" object which behaves according to

[73] For the earlier dating, see J.C. VanderKam, "Jubilees," *EDSS* 1:434–38. For a later dating, see M. Kister, "Concerning the History of the Essenes," *Tarbiz* 56 (1987): 1–18 (Hebrew); C. Werman, "The Book of Jubilees and the Qumran Scrolls," *Meghillot* 2 (2004): 37–55 (Hebrew). Werman does not note the disagreement between *Jubilees* and the Qumran position with regard to the moon's status in calendar reckoning, however.

[74] Pfann, "The Writings in Esoteric Scripts," 186.

simplistic, linear, and ever-recurrent schemes. This was the price paid for the originality of 4Q317. From then onwards, the Qumran discipline was restricted to sacred arithmetics.

CHAPTER 4

THE ASTRONOMICAL BOOK AND BABYLONIAN ASTRONOMY: MUL.APIN AND EAE

The first assertion of cultural contact between Enochic and Babylonian astronomy was made by Weidner in 1916. His theory was subsequently substantiated by VanderKam and Albani.[1] The present chapter will survey the teaching of the early astronomical source Mul.Apin and re-examine its similarities and differences vis-à-vis AB.

4.1 THE ASTRONOMICAL TEACHING OF MUL.APIN

Following the publication of the critical edition of Mul.Apin in 1989, the astronomical teaching contained in this text has received considerable attention in several comprehensive studies.[2] According to Hunger and Pingree, the thematic division of Mul.Apin runs as follows:[3]

a catalogue of stars divided into three "paths"

b dates of heliacal risings

c simultaneous risings and settings

[1] E. Weidner, "Babylonisches im Buche Enoch," *OLZ* 19 (1916): 74–75. See further, O. Neugebauer, "The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72 to 82)," "Appendix A" in M. Black, *The Book of Enoch or 1 Enoch* (SVTP 7; Leiden: Brill, 1985), 387, who acknowledges the contact while retaining some reservations; J.C. VanderKam, *Enoch and the Growth of an Apocalyptic Tradition* (CBQMS 16; Washington, DC: Catholic Biblical Association, 1984), 93–102; U. Glessmer, "Das astronomische Henoch-Buch als Studienobjekt," *BN* 36 (1987): 69–129; M. Albani, *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch* (WMANT 68; Neukirchen-Vluyn: Neukirchener, 1994).

[2] W. Horowitz, *Mesopotamian Cosmic Geography* (Winona Lake, IN: Eisenbrauns, 1998), 150–92; H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (HdO I, 44; Leiden: Brill, 1999), 57–83; D. Brown, *Mesopotamian Planetary Astronomy-Astrology* (CM 18; Groningen: Styx, 2000), 115–20; B. Brack-Bernsen, "The 'Days in Excess' from MUL.APIN. On the 'first intercalation' and 'water clock' schemes from MUL.APIN," *Centaurus* 47 (2005): 1–29.

[3] H. Hunger and D. Pingree, *Mul.Apin: An Astronomical Compendium in Cuneiform* (AfOBei 24; Horn, Austria: Berger, 1989), 13. Albani, *Astronomie und Schöpfungsglaube*, 176–77, suggests a subtler division.

d time-intervals between the dates of heliacal risings

e culminating (*ziqpu*) stars

f the path of the moon

g first intercalation scheme

h observations of heliacal risings and wind directions

i planetary theory

j second intercalation scheme

k shadow-length tables

l water-clock measurements of lunar visibility

m omina

Mul.Apin is a collection of astronomical lists representing the state of the art of astral sciences in Mesopotamia in the late second and early first millennia B.C.E. It epitomizes the traditional view of the heavenly bodies represented in earlier Mesopotamian literature, primarily for the purposes of divination, and as such constitutes the concluding stage of that early astronomical discipline. Around the seventh B.C.E., more advanced techniques of observation and calculation developed, paving the way for the emergence of the mathematical astronomy of the Persian and Hellenistic periods.[4]

Mul.Apin embodies the basic tools available for a Mesopotamian diviner/astronomer in the early first millennium B.C.E. The first half of the text is primarily dedicated to the risings of fixed stars. The first list (section a) lists 71 stars, dividing them according to their north-south position between the three "paths of heaven."[5] Section b designates the date of the heliacal rising for selected stars. This data is further elaborated in sections c and d by the calculation of simultaneous risings and settings and the time intervals between the risings of various stars and constellations. Most of the lists are based on

[4] See D. Brown, "The Scientific Revolution of 700 BC," in *Learned Antiquity: Scholarship and Society in the Near-East, the Greco-Roman World, and the Early Medieval West* (ed. A.A. MacDonald, M.W. Twomey, and G.J. Reinink; Leuven: Leuven University Press, 2003), 1–12.

[5] On the paths of heaven, see Horowitz, *Mesopotamian Cosmic Geography*, 165, 252–56; Hunger and Pingree, *Mul.Apin*, 139.

schematic concepts concerning the geography of heaven and the division of the year rather than on observation.

The following sections discuss elements which later became central in Babylonian astronomy. These include a list of culminating (*ziqpu*) stars (section e) and a list of "gods in the path of the moon" (section f)—seventeen constellations which stand in proximity to the ecliptic. Although Mul.Apin is aware of the ecliptic band, it does not divide it into twelve constellations or signs as do later texts.[6] It also states that the sun and the planets follow the same path as the moon (II i 1–8). The author is unable to track the sun's position at any given moment, presenting only a rather crude scheme for the placement of the sun, based on its rising point on the horizon, in the "first intercalation scheme" (section g). This fact constitutes further evidence that when Mul.Apin was composed, knowledge of the zodiac was still unavailable.[7]

Sections g and j treat some of the basic astronomical variables affected by the course of the year. Although these are usually referred to as "intercalation schemes," this designation is not entirely warranted. These passages present an ideal model which connects the primary markers for the alteration of the seasons: 1) the dates of the cardinal points in the sun's orbit; 2) the stars whose heliacal risings mark the cardinal days; 3) the variations in the rising point of the sun on the horizon; and 4) the length of daylight. The first intercalation scheme links these four phenomena together, producing a concise, narrative-like account of the annual advance of the seasons.

The author of Mul.Apin also instructs the practitioner concerning how to act when—inevitably—the ideal model fails to correspond to astronomical reality. Thus in Mul.Apin II i 23–24 (section g), the reader is called upon to observe the above-noted phenomena in order to calculate the "days in excess" ($\text{U}_4^{\text{meš}}$ $\text{DIRI}^{\text{meš}}$, *ūmē atrūti*).[8] The

[6] For the early history of the ecliptic and the zodiac, see L. Brack-Bernsen and H. Hunger, "The Babylonian Zodiac: Speculations on its Invention and Significance," *Centaurus* 41 (1999): 280–92; F. Rochberg, *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture* (Cambridge: Cambridge University Press, 2004), 123–31.

[7] Hunger and Pingree, *Mul.Apin*, 148, believe that both section f and the planetary section i are in fact secondary additions to the original text of Mul.Apin.

[8] The purpose and meaning of the "days in excess" are debated. David Brown has claimed that the observational value of these added days is very limited and that they constituted a tool employed by the diviner to manipulate the observational data, a practice attested in such contemporary texts as the Diviner's Manual: see Brown,

"second intercalation scheme" (section j) provides several additional rules for the intercalation of the year. This section elaborates on the "days in excess" by employing mathematical explanatory methods of the type common in the Mesopotamian scholarly milieu.[9]

Section h connects the risings of certain stars with the direction of the wind which was blowing when they rose and prescribes certain ritual acts to be performed in consequence of this event. Section i provides an ideal scheme for planetary phenomena, recording periods of visibility and invisibility. As in earlier sections, section i uses round numbers far removed from actual reality.

Two of the concluding sections in Mul.Apin make use of the traditional Babylonian "water-clock formula" for the purpose of tracking additional celestial phenomena. Section k presents a model for measuring and interpreting the length of the shadow cast by a *gnomon*—a vertical shadow-casting stick used to determine various times of the day throughout the seasons. Section l records schematic time periods of lunar visibility throughout the days of the month. The document concludes with a section containing various celestial omina. The inclusion of this section serves as an indication of the composition's setting and purpose.

Mul.Apin thus constitutes a handy compendium of the popular astronomy of the late second and early first millennium. It enjoyed enormous popularity and influence amongst astronomers of that period and afterwards, in various parts of the ancient world. Not only was it the basic paradigm adopted by Assyrian and Babylonian scholars during the height of the Sargonide dynasty in the eighth–seventh centuries B.C.E., but signs of the existence of Mul.Apin-type astronomy also exist in cultures as remote as Greece, India, Egypt, and Judaea, as late as the Hellenistic-Roman period (see below 4.2).

Mesopotamian Planetary Astronomy-Astrology, 117ff; A.L. Oppenheim, "A Babylonian Diviner's Manual," *JNES* 33 (1974): 197–220; C. Williams, "Signs from the Sky, Signs from the Earth: The Diviner's Manual Revisited," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 473–85. On the other hand, L. Brack-Bernsen ("The 'Days in Excess' from MUL.APIN") has recently claimed that the "days in excess" were used to correct the ideal model on observational grounds.

[9] A. Livingstone, *Mystical and Mythological Explanatory Works of Assyrian and Babylonian Scholars* (Oxford: Clarendon, 1986), 20–63.

4.1.1 *The "Water-Clock Formula"*

One of the important elements in the theory underlying Mul.Apin was the measurement of the length of daytime and night time by units of the water clock.[10] The day-length formula runs as a thematic thread through nearly every section of the compendium: the rising times of fixed stars (section b), the rising points of the sun on the horizon (section g), the shadow-length tables (section k), and lunar visibility (section l). We shall indicate below the extent to which this principle was also significant in the formation of Enochic astronomy.

According to Babylonian practice, day and night were each divided into three periods, designated by the term "watch" (EN.NUN, *maṣṣartu*). The length of these watches was measured by units of *mina*, reflecting the amount of water which flowed from the water clock during the measured period of time. Another measurement in use was that of the *uš* (≈ 4 minutes).[11] The period of time measured by 1 *mina* is equivalent to 60 *uš*.

The length of day and night changes through the seasons. The formula for the change in day- and night-length, which we have designated here "the water-clock formula," already appears in the Old Babylonian tablet BM 17175:[12]

Spring Equinox	15 Nissanu (15/I)	Day–3 *mina*; night–3 *mina*
Summer Solstice	15 Du'uzu (15/IV)	Day–4 *mina*; night–2 *mina*
Autumn Equinox	15 Tašritu (15/VII)	Day–3 *mina*; night–3 *mina*
Winter Solstice	15 Tebetu (15/X)	Day–2 *mina*; night–4 *mina*

[10] For the use of the water clock in ancient Mesopotamia, see D. Brown, J. Fermor, and C. Walker, "The Water Clock in Mesopotamia," *AfO* 46–47 (1999/2000): 130–48; J. Fermor and J.M. Steele, "The Design of Babylonian Waterclocks: Astronomical and Experimental Evidence," *Centaurus* 42 (2000): 210–22; cf. also O. Neugebauer, "The Water Clock in Babylonian Astronomy," *Isis* 37 (1947): 37–43 (repr. in idem, *Astronomy and History: Selected Essays* [NY: Springer, 1983], 239–45). These more recent studies have rendered Neugebauer's older work superfluous.

[11] See M.A. Powell, "Maase und Gewichte," *RlA* 7:467–68.

[12] BM 17175+17284 was published in Hunger and Pingree, *Mul.Apin*, 163–64; see other early parallels in Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 130. For the antiquity of this model, see Brown, *Mesopotamian Planetary Astronomy-Astrology*, 128–29, 249.

These data can also be expressed in the form of a linear zigzag function. According to this table, the M:m ratio of the longest to shortest day is 2:1. This persisted as the standard ratio in cuneiform literature, despite the fact that it does not correspond to the actual day length in any part of Mesopotamia. Only in much later periods do more accurate numbers appear (see below on section k). An M:m ratio of 2:1 also is employed in *1 Enoch* 72.

The year employed in the water-clock calculations is an ideal one of 360 days. This is clear from the passage 1 iii 49–50, for instance: "The stars enter into the night in the morning 1 *uš* every day. The stars come out into the day in the evening 1 *uš* every day," with the unit *uš* standing for both a spatial measure—1^{o} of the circle of heaven—and a temporal measure—$^{1}/_{360}$ of the day = $^{1}/_{30}$ of a *bēru* (double hour).[13] The above passage thus states that the rising points of fixed stars "move" in relation to the observer, the stars ostensibly appearing later every day by four minutes and completing a full round in 360 days. The number 360 is further reflected in other calculations throughout Mul.Apin.

The year is divided into four equal parts, each containing 90 days. The cardinal points of the year are dated in Mul.Apin within months I, IV, VII, and X in accordance with the Assyrian custom. In contrast, texts of Babylonian origin assign the cardinal days to months III, VI, IX, and XII. Thus while in Mul.Apin the equinox (Nisan 15) ideally falls *after* the spring New Year (Nisan 1), in Babylonian texts it was conceived to precede it.[14] Besides Mul.Apin, the Assyrian custom is

[13] See Horowitz, *Mesopotamian Cosmic Geography*, 185; Powell, "Maase und Gewichte." The statement quoted here from Mul.Apin finds a close parallel in a *ziqpu*-star text (BM 38369+ lines 25–28) which is related to Mul.Apin in many ways: see W. Horowitz, "Two New Ziqpu-Star Texts and Stellar Circles," *JCS* 46 (1994): 89–98; Hunger and Pingree, *Astral Sciences in Mesopotamia*, 89.

[14] On the changing date of the equinoxes in Mesopotamian practice, see W. Horowitz, "The 360 and 364 Day Year in Ancient Mesopotamia," *JANES* 24 (1996), 42–44, and earlier bibliography cited there; F.N.H. Al-Rawi and A. George, "Enūma Anu Enlil XIV and Other Early Astronomical Tablets," *AfO* 38–39 (1991/1992), 61. Cf. also the Neo-Assyrian letter SAA VIII §165, lines 5ff:

^{iti}ŠE ^{iti}KIN SAG MU.AN.NA ki-i ša ^{iti}BARAG ^{iti}DU$_{6}$ ina SAG MU.AN.NA

(this year) the months Adar and Elul begin the equinox-year, what the months Nisan and Tišri (normally) do (translation following M.E Cohen, *The Cultic Calendars of the Ancient Near East* [Bethesda, Maryland: CDL Press, 1993], 400).

It may be possible that the change in date of the cardinal days occurred due to the divergent climate conditions in northern and southern Mesopotamia, the crops in the north usually ripening later than in the south. This idea was suggested by Talmon in reflected in the Ivory Prism and related texts.[15] In contrast, the Jewish 364DCT fixes the cardinal days "between the seasons of the months" (*Jub* 29:16)—i.e., at the very end or beginning of the months, rather than in their middle (see above 1.3).

Daytime and night time each comprise three watches, six watches constituting a nychthemeron. The units of *mina* in the "water-clock formula" indicate both the weight of water and the length of time intervals, which in this scheme are taken to be coterminous.[16] The wording of the formula was once taken to indicate that each of the six watches lasted for 2, 3, or 4 *mina*. For example, at the equinox:

> 3 MA.NA EN.NUN u_4-mi 3 MA.NA EN.NUN GI_6
>
> 3 minas is a daytime watch, 3 minas is a night-time watch

According to this interpretation—now proven to be erroneous—the entire nychthemeron would last 3 x 6 = 18 *mina*.[17] Although the number of 18 *mina* equals the number of parts of daylight in *1 Enoch* 72, the same 2:1 longest to shortest day ratio obtaining there as in Mul.Apin, it is now clear that this constitutes an mistaken interpretation of the "water-clock formula." The time period of 3 *mina* measuring the entire night (or day) rather than a single "watch," 1 *mina* consequently constitutes the measurement for one third of the equinoctial night (or day), the entire nychthemeron lasting 6 *mina*.[18]

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regard to Jeroboam I's calendar reform in the northern Israelite Kingdom: see S. Talmon, "Divergencies in Calendar-reckoning in Ephraim and Judah," *VT* 8 (1958): 48–74.

[15] For the Ivory Prism, see Hunger and Pingree, *Astral Sciences in Mesopotamia*, 112–15. A related text which uses the same practice is K 3145, a commentary on EAE 20, published by F. Rochberg-Halton, *Aspects of Babylonian Celestial Divination: The Lunar Eclipse Tables of Enūma Anu Enlil* (AfOBei 22; Horn: Berger, 1988), 225–26; see Al-Rawi and George, "Enūma Anu Enlil XIV," nn. 24, 30.

[16] In an early study ("The Water Clock in Babylonian Astronomy"), Neugebauer claimed that, the ancients being aware of the dissimilarity of the two parameters, a different interpretation for the use of the water clock should be adopted. This suggestion has now been disproved: see Hunger and Pingree, *Astral Sciences in Mesopotamia*, 81; Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 130–32.

[17] This view was maintained by U. Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin and in the Astronomical Book of 1 Enoch," *Henoch* 18 (1996), 262–63; contrast Al-Rawi and George, "Enūma Anu Enlil XIV," n. 23.

[18] See the decisive evidence in Al-Rawi and George, "Enūma Anu Enlil XIV," 60; cf. Hunger and Pingree, *Astral Sciences in Mesopotamia*, 46; Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 132, 135. The encyclopedia article by

Mul.Apin consequently does not present a parallel to the eighteen parts of AB, for which a different source must be sought (see below 4.3.2).

In the following discussion, we shall pay special attention to the sections of Mul.Apin in which the "water-clock formula" appears, given that the formula represents a concise articulation of the schematic year and the celestial phenomena associated with it.

4.1.2 *The First Intercalation Scheme*

Section g links several astronomical phenomena within a framework formed around the four cardinal days of the year. The solstices are marked by the rising of the Arrow star at sunrise (summer) or sunset (winter). The place of the moon with respect to key constellations at the equinoxes is also noted. Following this comes data on the length of daytime and night time as derived from the "water-clock formula." The section also includes material concerning the sun's rising point—as, for example, in II i 11–12:

> ^{d}UTU šá ina id ^{im}SI.SÁ KI SAG.DU ^{mul}UR.GU.LA KUR-ḫa
>
> GUR-ma ana id ^{im}U$_{18}$.LU u$_{4}$-mu 40 NINDA.TA.ÀM ul-ta-nap-pal
>
> The Sun which rose towards the North with the head of the Lion turns and keeps moving towards the South at a rate of 40 NINDA per day.

The position of the sun on the horizon is expressed here by its correspondence to the rising point of certain fixed stars. In addition, the text notes the direction of the change in the sun's rising point along the horizon and supplies a schematic number for the rate of its advancement.

Powell in *RlA* 7:468 notes the different views with regard to the number of *minas* during the night but does not resolve them in favour of one or the other.

The section concludes with a programmatic statement (II i 22–24):

> DIŠ ina ^{iti}BÁR UD 15 KAM ina ^{iti}ŠU UD 15 KAM ina ^{iti}DU$_{6}$ UD 15 KAM ina ^{iti}AB UD 15 KAM
>
> KUR^{meš} ša ^{d}UTU NA^{meš} ša ^{d}Sin IGI.DUḪ.A^{meš} ša ^{mul}KAK.SI.SÁ ŠEŠ-ár UD^{meš} DIRI^{meš} IGI.LÁ
>
> On the 15th of Nisannu, on the 15th of Duʾuzu, on the 15th of Tešritu, on the 15 of Ṭebetu,
>
> You observe the risings of the Sun, the visibility times[19] of the Moon, the appearances of the Arrow,
>
> And you will find how many days are in excess.

As Brack-Bernsen has noted, the designation “intercalation scheme” fails to do justice to this section, which encapsulates all the important annual phenomena.[20] Although intercalation forms an element of the text, it does not constitute its central focus. In contrast, intercalation seems to be more evidently present in the “second intercalation scheme.”

4.1.3 *The Second Intercalation Scheme and the 364DY*

Section j is longer than the first intercalation scheme, spanning more than one column of text (II Gap A 1–II ii 20). As with the first intercalation scheme, this text traces the central markers of the advance of the seasons in an ideal year, although it also contains additional elements. The customary account of the course of the year is followed by reflections on possible modes of operation to be adopted if and when the scheme fails. The contents of section j are as follows:

[19] Hunger and Pingree read the term NA^{meš} as *nanmurtū* and accordingly translate “visibility time.” They also suggest the reading *manzāzu* (*Mul.Apin*, 129); cf. also Brown, Fermor, and Walker, “The Water Clock in Mesopotamia,” n. 30. In either case, the term refers to the time periods between the rising and setting of sun and moon at the syzygies—later grouped to form the “Lunar Six.” This type of measurement appears in various degrees of detail in Mul.Apin section l, as well as in EAE 14, the Diviner’s Manual, and a variety of observational texts.

[20] Brack-Bernsen, “The ‘Days in Excess’ in MUL.APIN,” 8.

The sun's position in the Paths of Heaven and weather conditions (Gap A 1–7)

Indicators for intercalation based on the rising of fixed stars (Gap A 8–ii 10)

A mathematical elaboration of the triennial intercalation cycle (ii 11–17)

Intercalation in Nisannu, Addaru or Ululu (ii 18–20)

An important structural marker is found in the recurrence in ii 10 and ii 17 of a nearly identical line treating the addition of a month every three years. This is a resumptive repetition[21]—an editorial tool which reveals that the intervening section digresses from the contents of the previous paragraph and indicating that the original line of argument flowed from ii 10 to ii 18.

Paragraph 1: Gap A 1–7

This paragraph is of especial importance for Enochic astronomy, covering as it does such important elements of AB as the Paths of Heaven and their relation to weather phenomena. We quote here from Horowitz's translation:[22]

1. From the 1st of Adar to the 30th of Iyar, the Sun travels in the Path of Anu; breeze and warm wea[ther].[23]

2. From the 1st of Sivan to the 30th of Av, the Sun travels in the Path of Enlil; harvest and heat.

3. [Fr]om the 1st of Elul to the 30th of Araḫšamnu, the Sun travels in the Path of Anu; breeze and warm weather.

4. [From the 1s]t of Kislev to the 30th of Ševat, the Sun travels in the Path of Ea; cold weather.

Whereas in the first intercalation scheme the sun's position was expressed by its conjunction with prominent fixed stars, here it is noted in relation to the Paths of Heaven (Path of Enlil = North; Path of Anu = middle; Path of Ea = South). In Mesopotamian astronomical

[21] M. Anbar, "La 'reprise'," *VT* 38 (1988): 385–98.
[22] Horowitz, *Mesopotamian Cosmic Geography*, 254.
[23] This is the translation of *zīqu u ṣētu*, following CDA 337, 448; *contra* CAD Z 133b and CAD Ṣ 152b.

texts, the Paths most commonly signify sections of the horizon rather than a division of the entire sky.[24] While Horowitz has adduced some literary texts in which the entire sky is divided into three paths,[25] the fact that the context in Mul.Apin is astronomical rather than literary would appear to suggest that, in similar fashion to the first intercalation scheme, the second intercalation scheme is confined to records of the sun on the horizon.

In the above-quoted account, the sun remains in each path for three months, the latter being assigned in such a way as to ensure that the cardinal points fall precisely in the middle of each season. Thus, for example, the autumn equinox of Tišri 15 occurs halfway between Elul 1 and Araḫšamnu 30 (line 5). The data on the sun's position can thereby be expressed by means of a zigzag function, with the extreme values being assigned to the cardinal days. This model closely corresponds to *1 Enoch* 72, where six "gates" came to replace the three "paths."[26]

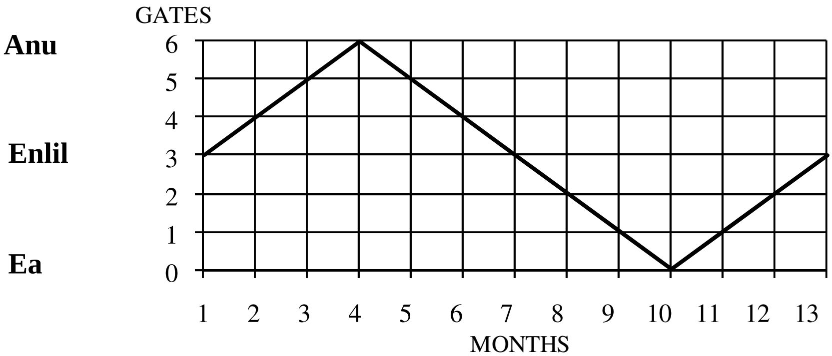

FIGURE 4.1: The position of the sun in the gates/paths of heaven

Paragraph 2: Gap A 8–ii 10

This paragraph opens with a presentation of seven "control points" devised in order to ensure that the year does not lag behind true astronomical reality. The check is conducted by means of stellar

[24] See E. Reiner in collaboration with D. Pingree, *Enūma Anu Enlil, Tablets 50–51* (BPO 2; Malibu: Undena, 1981), 17.

[25] Horowitz, *Mesopotamian Cosmic Geography*, 255.

[26] In order to underscore the similarity, the table avoids expressing the difference in the dating of the cardinal days (on the first of the month in AB, as opposed to the fifteenth day in Mul.Apin). The difference does not undermine the basic correspondence between the two systems.

phenomena whose occurrence normally falls on a fixed date in the ideal year—primarily the rising of fixed stars and the moon's conjunctions with these stars. Among the stars indicated, special place is given to the Pleiades and the Arrow.[27] Since the intercalation rules in this section are based on a schematic approximation of the order of stars, they are not always applicable.[28] David Brown has made the more radical claim that these rules possess no correspondence to observational reality but were rather deduced from the simple rule of thumb that dictates the intercalation of one month every three years.[29] This principle is indeed presented at the end of the section.

As is common in Mul.Apin, the list of intercalation rules concludes with instructions as to how to act when the stars do not match the ideal scheme (II ii 7–10):

> 7. [X]$^{\text{meš}}$ MUL$^{\text{meš}}$ šá šu-ut $^{\text{d}}$É-a šu-ut $^{\text{d}}$A-nim šu-ut $^{\text{d}}$En-líl
>
> 8. [MU]L?$^{\text{meš}}$-šú-nu (var: X u SAR$^{\text{meš}}$-šú-nu] KI[N-m]a? MU BI ta-nab-bi
>
> 9. ki-ma … […] u MU.AN.NA tuš-ba-lam-ma
>
> 10. ina 3 MU$^{\text{meš}}$ (var: 3 KAM) ME-a GAR-ma MU [BI DI]RI.GA ME-bi
>
> 7. You l[ook?] for the risings(?) and … of the stars of Ea, Anu and Enlil
>
> 8. And name this year;
>
> 9. When …, you compute […] and year, and
>
> 10. For the third year you make a prediction, and proclaim this year a leap year.

[27] For the use of the Pleiades in intercalation, see M. Albani, "'Der das Siebengestirn und der Orion macht' (Am 5,8): Zur Bedeutung der Plejaden in der israelitischen Religionsgescichte," in *Religionsgeschichte Israels: formale und materiale Aspekte* (ed. B. Janowski and M. Köckert; Gütersloh: Kaiser, 1999), 139–207; E. Robbins, "The Pleiades, the Flood and the Jewish New Year," in *Ki Baruch Hu: Ancient Near Eastern, Biblical, and Judaic Studies in Honor of Baruch A. Levine* (ed. R. Chazan, W.W. Hallo, and L.H. Schiffman; Winona Lake, IN: Eisenbrauns, 1999), 329–44. For other intercalation schemes based on the appearances of fixed stars, see H. Hunger and E. Reiner, "A Scheme for Intercalary Months from Babylonia," *WZKM* 67 (1975): 21–28.

[28] Hunger and Pingree, *Mul.Apin*, 152.

[29] Brown, *Mesopotamian Planetary Astronomy-Astrology*, 118ff.

Line 10 expresses the principle (repeated also in line 17) that adding a month once every three years ensures that the year remains aligned with the seasons. This idea originated in very ancient times, a cycle of thirty-seven lunations already being known in Mesopotamia in the fourth (!) millennium B.C.E.[30] By the time of Mul.Apin's composition, however, scribes were already aware that this rule was far from accurate and that astronomical reality occasionally required intercalation more frequently.[31] The question therefore needs to be asked why this rule was adopted and even elaborated in lines 11–17. The scholars who espoused Mul.Apin took this ideal "rule" as a point of departure for their regular check of celestial phenomena; indeed, the triennial cycle itself became part of the ideal scheme. Every month an inspection was conducted to examine whether this cycle could be maintained or whether intercalation was required earlier.

Lines 11–17 further elaborate the triennial intercalation cycle:

> 11. To … the day of disappearance of the Moon[32] for 12 months, you proclaim an intercalary month in three years (var: the third year);

[30] See Horowitz, "The 360 and 364 Day Year in Ancient Mesopotamia," 39.

[31] For a brief review of pre-mathematical intercalation methods, see J.P. Britton, "Treatments of Annual Phenomena in Cuneiform Sources," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 25–26.

[32] This is Hunger and Pingree's translation (*Mul.Apin*, 94–95), which contains no English rendering of the verb *šutākulu* (*Št akālu*)—a common verb in mathematical texts with the meaning "to multiply, square" (CAD A/I p. 258; CDA, 9)—in line 11. J. Høyrup has recently suggested that this verb should be read as *šutakūlu* (from *kullum*, "hold, make [the two segments] hold each other"): see J. Høyrup, "How to Educate a Kapo, or: Reflections on the Absence of a Culture of Mathematical Problems in Ur III," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 126–27. In line 11, this verb does not fit its subject UD.NÁ.A, *ūm bubbuli*, "the day of disappearance of the moon," since a "day" as such cannot be part of a multiplication or a square; cf., for example, the smoother diction in the Diviner's Manual, where the verb *šeʾû* is employed with the same subject (lines 58–61, "*bi-ib-li* … KIN.KIN-*ma*"). It is therefore possible that the logogram UD.NÁ.A in line 11 signifies one of the lunar intervals later included in the "Lunar Six" under the designation KUR, which is measured on the day of last visibility. The use of UD.NÁ.A for KUR is attested in VAT 4936, a copy of an astronomical diary from c. 424 B.C.E. (ADRTB 1:66). According to this interpretation, line 11 instructs the astronomer to calculate the length of KUR in order to predict the lengths of months and, concomitantly, of the entire year. For such uses of the Lunar Six in the later document TU 11, see L. Brack-Bernsen, "Predictions of Lunar Phenomena in Babylonian Astronomy," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 11–13. Although methods of this kind are only known from a later period,

12. 10 additional days in 12 months is the amount for one year.

13. If you are to find the correction for day, month, and year:

14. you multiply 1,40, the correction for a day, by one month,

15. and you find 50, the correction for one month; you multiply 50, the correction for one month,

16. by 12 months, and you find 10 additional days, the amount for one year.

17. In three years (var: the third year) you proclaim (this year) a leap year.

As noted above, line 17 is a repetition of line 10, the intervening lines constituting a mathematical elaboration of the repeated line. Since it is intended that 30 days be added every three years, the average addition for a year is 10 days (line 12). This number is divided in turn until the correction for one day is found (line 14); this is then multiplied back to the original 10 days per year (line 16). Hunger and Pingree describe the process as follows:

> … the epact is assumed to be 10 days. For 10 days distributed over 12 months is 0;50 days per month; and 0;50 days distributed over 30 days is 0;1,40 days per day.[33]

Lines 13–17 should consequently be seen as a commentary on lines 11–12, as both Koch and Horowitz have argued.[34] A similar section to this numerical commentary also appears in a Babylonian explanatory text, a fact which possibly suggests that lines 13–17 are a gloss added to Mul.Apin.[35]

Although the calculations in lines 13–17 presuppose an ideal year of 360 days as in the rest of Mul.Apin, lines 11–12 appear to

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Brack-Bernsen claims that they originated in older practice. Line 11 would then read: "in order to multiply KUR for 12 months, you proclaim an intercalary month in three years."

[33] *Mul.Apin*, 153. These numbers are not decimal numbers, of course, but Babylonian sexagesimal numbers.

[34] J. Koch, "Kannte man in Mesopotamien das 364 Tage-Jahr wirklich seit dem 7. Jahrhundert v. Chr.?," *NABU* 1997/119, 111; W. Horowitz, "The 364 Day Year in Mesopotamia, Again," *NABU* 1998/49, 50.

[35] The explanatory text is K 2164 + rev. 25–29, from the series i.NAM.giš. ḫur.an.ki.a, published in Livingstone, *Mystical and Mythological Explanatory Works*, 24–25, 42; see also Brown, *Mesopotamian Planetary Astronomy-Astrology*, 120 n. 306. Ancient Mesopotamian commentaries frequently elaborate on the numerical dimension in natural phenomena and authoritative texts: see Livingstone, *Mystical and Mythological Explanatory Works,* 20–48.

presuppose a different year length. Line 12 makes no sense in relation to the ideal year, dictating as it does an unreasonable average year length of 360 + 10 = 370 days. The author of lines 11–12 must therefore have related to the average *lunar* year of 354 days. When 30 days are added to this every three years, an average year length of 364 days is reached.[36] Although this number is never made explicit in Mesopotamian literature, it probably existed in the present section of Mul.Apin. As Britton concludes, this section demonstrates a growing awareness amongst seventh century B.C.E. scholars of the insufficiency of the old ideal models and the need for more accurate calculations. Indeed, soon after Mul.Apin, the 364DY yielded to years of 364.5 and 365 days, etc.[37]

The 364DY appears in Mul.Apin only peripherally and is never implemented in the actual astronomical models. The number 364 existed in Mesopotamian astral lore for a very short period, being very quickly replaced by more accurate numbers. It continued to exist, however, in later Jewish circles, where it became the cornerstone of a rich tradition of cosmological thought.

4.1.4 *The Shadow-length Table*

Section k elaborates the water-clock model, applying it to a more complicated phenomenon than those discussed in the essential scheme. It includes some basic principles for interpreting the lengths of the shadow cast by a *gnomon*, from which the time of the day is deduced. The data are formally given as tables, pointing to a correspondence between the shadow length (in cubits) and the time which has passed since sunrise, measured in *bēru*. Separate tables are dedicated to the shadow length in each of the solstices and equinoxes. Finally, the number of "the difference for 1 cubit of shadow" is calculated in II ii 41–42.

Section k is thus a preliminary manual for the use of a sundial. Although this time-measuring device was not common in ancient Mesopotamia, sources such as the present section—together with

[36] For the argument in detail, see Horowitz, "The 364 Day Year in Mesopotamia, Again," 50; cf. Brown, *Mesopotamian Planetary Astronomy-Astrology*, 120 and n. 305.

[37] Britton, "Treatments of Annual Phenomena," 23–26.

some additional astronomical texts—reveal that it was known and occasionally used.[38] The statement by Herodotus (*Hist.* 2.109.3) that the Greeks learned from the Babylonians how to use a *gnomon* is thus at least partially justified. The sundial of section k is not particularly useful, however, as the section measures shadows cast on a horizontal plane which are up to 10 cubits long. Such a diameter is too large for a functioning device.

The actual interpretation of the shadow-length tables remains controversial. As in sections b and g above, the "water-clock formula" with its traditional 2:1 ratio is quoted at the beginning of each season. Neugebauer's reasoning, however, has rendered the interpretation more problematic.[39] According to him, the columns of section k constitute tables of reciprocals, based on mathematical equations rather than on observation. The length of the day implied by the these tables of reciprocals, according to Neugebauer, is 2 or 3 *mina* at the solstices and 2;30 *mina* at the equinoxes. This ratio does not correspond to the traditional 2:1 ratio but rather to the ratio of 3:2, known only from later texts.[40] In addition, Neugebauer's interpretation necessitates switching the order of the columns for summer and winter in section k, a rather bold act for a modern interpreter.[41]

R. Bremner has offered an alternative analysis which, although far reaching in its implications, more closely follows the sequence of section k.[42] According to Bremner, the tables in section k measure the length of arcs on the horizon, in which the sun is present in the various seasons. Bremner's interpretation allows an interpretation of section k on the basis of the 2:1 traditional ratio. Glessmer, who has adopted this interpretation, claims that:

[38] See Hunger and Pingree, *Astral Sciences in Mesopotamia*, 80.

[39] Neugebauer, *HAMA*, 544. This interpretation has been accepted by Hunger and Pingree, *Mul.Apin*, 153–54; idem, *Astral Sciences in Mesopotamia*, 79–81; Horowitz, *Mesopotamian Cosmic Geography*, 192.

[40] This aspect was particularly criticized by Brown, *Mesopotamian Planetary Astronomy-Astrology*, 120; Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 140–41—who claim that the ratio 3:2 was only reached at a much later period and could not possibly have already been present in Mul.Apin.

[41] The latter aspect was particularly noted by Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," 264–65.

[42] R. Bremner, "The Shadow Length Table in Mul.Apin," in *Die Rolle der Astronomie in den Kulturen Mesopotamiens: Beiträge zum 3. Grazer morgenländischen Symposion* (ed. H.D. Galter; Graz: GrazKult, 1993), 367–82. This interpretation was accepted by Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin."

> … the combination of minas and corresponding watches with the time-angle and shadow-length ratios better permits usage of the celestial movement of the sun as a "clock."[43]

The interpretation suggested by Bremner and Glessmer connects section k with section g (the first intercalation scheme). According to these scholars, the data regarding the sun's azimuth in the "intercalation schemes" were not schematic and ideal, as is commonly thought, but were meant to generate advanced calculations of "time-angles" such as those employed in section k. This view was recently upheld (although only in passing) by Brack-Bernsen.[44] However, the measurement of time by arcs on the horizon seems to be foreign to Mul.Apin's mode of thought. It was rejected by Hunger and Pingree, Brown similarly dubbing it "anachronistic."[45]

In summary, section k is an elaboration of the water-clock model, outlining a schematic correspondence between the shadow length and the time which has passed since sunrise. A more satisfactory explanation for section k than that proposed by Neugebauer is presently a desideratum.

4.1.5 *Lunar Visibility: Mul.Apin Section l and EAE 14*

The water-clock model served as the basis for further elaborations on additional astronomical phenomena. Our final example pertains to periods of lunar visibility, a prominent element of early Mesopotamian astronomy which also appears to have played a crucial part in the development of later mathematical astronomy. Section l of Mul.Apin covers only a limited section of the topic, a wider discussion being found in tablet 14 of the divinatory series *Enūma Anu Enlil*. Together, the two sources reflect the state of the craft at the end of the second and beginning of the first millennia, although the extant copies we possess all derive from a considerably later period. The four tables contained in EAE 14 were published by Al-Rawi and

[43] Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," 269.

[44] Brack-Bernsen, "The 'Days in Excess' in MUL.APIN," n. 20.

[45] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 80; Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 130 and nn. 1, 6. Dr. John Steele tends to agree with this assertion (private communication, September 2007).

George based on numerous textual witnesses, including copies of the tablet and commentaries on its contents. Mul.Apin section 1 more or less reflects Table D of EAE 14, with slight variations. A closely-related source is the reverse of the first tablet in the series i.NAM.giš.ḫur.an.ki.a.[46] Brack-Bernsen has demonstrated how the lunar data computed in the above sources strongly influenced the later Goal-Year methods and the important predictive text TU 11.[47] It is thus clear that the theory of lunar visibility constituted a central element in Mesopotamian astronomy throughout the first millennium B.C.E. This field of knowledge also exerted considerable influence on astronomers outside Mesopotamia.[48] It would not therefore be surprising to find its influence also on Jewish astronomy of the Hellenistic period.

According to the water-clock model, the length of daylight and night time varies between 2 *minas* and 4 *minas* at the solstices, while at the equinoxes both day and night measure 3 *minas* each. At the same time, the schemes of lunar visibility reveal that the moon is seen during variable periods of daytime and night time during the month, as it rises approximately $^{1}/_{15}$ of the night later each day. The primary aim of EAE 14 and its related sources is to interconnect the two schemes—the length of night time and the periods of lunar visibility—in order to extract concrete numerical figures for the lunar visibility on each night of the year. In other words, summer nights being considerably shorter than winter nights, the exact length of $^{1}/_{15}$ of a night time can be computed for each night of the year using the "water-clock formula." This procedure is easily applied to the equinoctial month, in which night and day both measure 3 *minas* (= 180 *uš*), meaning that a period of $^{1}/_{15}$ of a night lasts 180/15 = 12 *uš*. Nor is it considerably more difficult for any other month of the year.

The moon is visible throughout the night only at full moon. According to the ideal scheme, the full disk rises at sunset on that night, remains visible throughout the night, and sets at sunrise. From

[46] Livingstone, *Mystical and Mythological Explanatory Works*, 22–29; Hunger and Pingree, *Astral Sciences in Mesopotamia*, 83f.

[47] L. Brack-Bernsen, "Goal Year Tablets: Lunar Data and Predictions," in *Ancient Astronomy and Celestial Divination* (ed. N.M. Swerdlow; Cambridge, Mass.: MIT Press, 1999), 149–77; eadem, "Predictions of Lunar Phenomena"; L. Brack-Bernsen and H. Hunger, "TU 11: A Collection of Rules for the Prediction of Lunar Phases and of Month Lengths," *SCIAMVS* 3 (2002): 3–90.

[48] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 48–50.

that day onwards, the moon rises approximately 48 minutes (= 12 *uš*) later every night. Thus during the waning phase of the month, the period of the moon's nightly visibility gradually decreases, while its visibility period increases during the day. Waning lasts for approximately fifteen days—half of an ideal month—hence the daily belatedness of $^{1}/_{15}$ of the night.

In contrast, the new crescent moon is first seen in the western horizon at sunset but sets soon afterwards. Again, its setting is delayed by around 12 *uš* every day. Hence during the waxing phase of the month the period of the moon's nightly visibility gradually increases, while its visibility decreases during the day. This process takes place over fifteen days during the first half of the ideal months.

The various tables of EAE 14 outline a method of tracing and measuring the periods of lunar visibility. Due to its significance for the interpretation of later Jewish sources, we shall discuss the method here in detail. It is expressed in four different tables:

Table A: Lunar visibility in an equinoctial month, measured by *uš* (Nippur style)

Table B: The same phenomenon, measured by water-clock units (Babylon style)

Table C: Length of daylight and night time throughout the year

Table D: Lunar visibility throughout the year

Tables A and B cover the simple case of the equinoctial night, which measures 3 *minas* according to the "water-clock formula." As they cover only one month, the Tables contain considerable detail, dedicating a line of description to every day of the month. The structure of each line in the first part of the month is as follows:

Sin	day n	time x	GUB

On day n the moon is seen (lit. "stands" *izzaz*) for time x (= night time visibility)

A longer formula describes every day in the second part of the month, beginning with day 16:

Sin	day n	time x	GUB	time y GI_6.ZAL

On day n the moon is seen for time x (= night time visibility); "pass" (= lunar invisibility)—for time y

These formulas point to the phenomenon described above. As the month begins, the period of nightly lunar visibility increases. The increase is not entirely linear: during days 1–5 the visibility period doubles every day, while during days 6–15 it increases by 12 *uš* daily (3 *mina* / 15 = 180 *uš* / 15 = 12 *uš*), altogether fifteen steps of growth. On day 15, the day of full moon, night-time lunar visibility is 3 *mina*, equaling the entire length of the equinoctial night.

The second part of Table A describes the nights during the month's waning phase. On these nights, night-time lunar visibility gradually decreases since the moon rises later every night. The visibility periods are a mirror image of those of the waxing phase: x stands for the night-time visibility, which diminishes by 12 *uš* daily during days 16–24 and then by half daily during days 25–29. The earlier part of the night, in which the moon is not visible, is measured by the figure y, which naturally increases as the month reaches its end. Thus x + y = 3 *mina*, the length of the entire equinoctial night:

y beginning of night, moon invisible

x end of night, moon visible

Table A concludes by stating that on day 30 "*Ilu ina ūmi izzaz*": the god—i.e., the (invisible) moon—is seen, so to say, throughout the whole day.

Table B gives similar data to those of Table A, the major divergence lying in the fact that the time intervals are measured by the water-clock units of *mina* and *šiqlu* rather than in *uš*. Further notes on Tables A and B are given below.

Table C constitutes a simple extrapolation of the length of daylight and night time according to the "water-clock formula." Rather than indicating day length only for the four cardinal days, as per the formula, Table C gives the length of day and night in twenty-four points along the year, twice every month, in the following manner:

Nisan 15 x *mina maṣṣarti ūmi* (day length)

y *mina maṣṣarti mūši* (night length)

Table C only measures the length of daytime and night time and does not relate to lunar visibility at all.

Table D unites all of the above data, recording lunar visibility at the beginning and middle points of every single month of the year. Visibility data are expressed according to a different method than that employed in Tables A and B. Rather than recording the period of visibility and invisibility every night, Table D computes two distinct figures for every month:

1. IGI.DU$_8$.A (*tāmartu*) *ša* ^{d}*Sin*, “visibility of the moon”

Period of lunar visibility after sunset on day 1 of the month

2. KUR (*nipḫu*) *ša* ^{d}*Sin*, “rising of the moon”

Period of lunar invisibility between sunset and moonrise at full moon

These figures relate to key moments in the course of every lunation—the new moon and full moon—constituting the first step of each half of the month. Sample lines of Table D run as follows:

ina Nisanni UD.1.KAM	11 uš 20 NINDA IGI. DU$_8$.A *ša* ^{d}*Sin*
ina Nisanni UD.15.KAM	10 uš 40 NINDA KUR *ša* ^{d}*Sin*
…	
ina Simani UD.1.KAM	8 uš 40 NINDA IGI. DU$_8$.A *ša* ^{d}*Sin*
ina Simani UD.15.KAM	8 uš KUR *ša* ^{d}*Sin*
…	
ina Ulūli UD.1.KAM	11 uš 20 NINDA IGI. DU$_8$.A *ša* ^{d}*Sin*
ina Ulūli UD.15.KAM	12 uš KUR *ša* ^{d}*Sin*
…	
ina Kislīmi UD.1.KAM	15 uš 20 NINDA IGI. DU$_8$.A *ša* ^{d}*Sin*
ina Kislīmi UD.15.KAM	16 uš KUR *ša* ^{d}*Sin*
…	
ina Addari UD.1.KAM	12 uš 40 NINDA IGI. DU$_8$.A *ša* ^{d}*Sin*
ina Addari UD.15.KAM	12 uš KUR *ša* ^{d}*Sin*

All the time intervals in Table D are computed as $^{1}/_{15}$ of the length of their respective nights, depending on the length of the night during that particular season. Following are some examples of the values of KUR on equinoctial and solsticial nights:

Equinox	Ulūlu 15, Adaru 15	KUR = 12 *uš* = 3 *mina* / 15
Summer Solstice	Simanu 15	KUR = 8 *uš* = 2 *mina* / 15
Winter Solstice	Kislimu 15	KUR = 16 *uš* = 4 *mina* / 15

The time intervals of IGI.DU$_8$.A and KUR are part of a set of six different time intervals measured between the rising and setting of the moon and sun. This set was used in a great variety of late Babylonian astronomical documents, as we shall examine in depth in Chapter 5. At this point it should be noted, however, that the logograms used to designate the discrete time intervals are not stable: the same periods called here IGI.DU$_8$.A and KUR carry different names in other texts. In the parallel table of Mul.Apin section l, for example, IGI.DU$_8$.A is replaced by the logogram ŠÚ (*rabû*), "setting."[49]

Section l of Mul.Apin is essentially identical to Table D of EAE 14, with only a few variations.[50] One of the obvious differences lies in Mul.Apin's practice of marking the cardinal days on months I, IV, VII, and X rather than on months III, VI, IX, and XII as in EAE. The list is "moved" accordingly, so that the value of 12 *uš* occurs on the equinoctial nights in Nisan 15 and Tišri 15. A second divergence can be seen in the fact that the Mul.Apin table also notes the calculated length of night time for every indicated date. Thus Mul.Apin section l combines the data of Tables C and D from EAE 14.

Finally, several lines are added in Mul.Apin II iii 13–15 which indicate a method for deducing the numerical values in the tables from multiplications of the "difference for daytime and night time." These three lines employ the number 4 as coefficient, a method based on traditional Babylonian mathematics.[51]

Excursus: Additional Notes on EAE 14

1. Several differences between Tables A–B and D should be noted.[52] In Tables A–B, maximum night-time visibility is reached on the night of the full

[49] The Diviner's Manual (line 16) retains the terms IGI.DU$_8$.A and KUR as in EAE 14, however.

[50] For the variations, see Brown, *Mesopotamian Planetary Astronomy-Astrology*, 114.

[51] See Al-Rawi and George, "Enūma Anu Enlil XIV," 62; Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 131; Brack-Bernsen, "The 'Days in Excess' in MUL.APIN," 11–12.

[52] The present discussion follows Hunger and Pingree, *Astral Sciences in Mesopotamia*, 48.

moon, which is taken to occur on day 15 of the month. Since according to the ideal count the full moon rises simultaneously with the setting sun, these Tables do not acknowledge the short time-intervals between sunset to moonrise on the day of the full moon. In contrast, Table D notes that such an interval does occur on day 15 of the month. According to Table D, therefore, the full moon appears on day 14 rather than on day 15. This fact makes it difficult to give a daily account of lunar visibility for all the days of a 30-day month.

In contrast to the geometrical progression of lunar visibility at the beginning of the month in Tables A and B, the length of first lunar visibility on day 1 according to Table D is precisely $^1/_{15}$ of the night.[53] Thus, for instance, at first visibility in the equinoctial month, sunset to moonset lasts for 3,45 *uš* according to Table A, a much shorter period than the 12 *uš* of Table D. Table D hence adheres more fully to the progression of visibility periods in increments of $^1/_{15}$ of the night.

The disparities between Tables A and D with regard to lunar visibility cannot be resolved by observation, both Tables being based on ideal schemes. An ambiguity appears to exist with regard to the precise place of the full moon within the ideal month, the different tables apparently employing slightly different conceptions of the lunar phases in a 30-day month.[54] We encountered a similar ambiguity in Enochic astronomy, as explained above (see the *Excursus* in 2.2.1).

Finally, a structural difference between Tables A–B and Tables C–D manifests itself in the fact that the former two Tables relate to a single month while the latter two cover the entire span of the year, although naturally in less detail. This distinction evokes the difference, noted in Chapter 2 above, between the various lunar passages in AB—those relating to the lunar month as opposed to those which treat the entire year.

2. Whereas Tables A–B relate to the equinoctial month, whose length is 3 *mina* = 180 *uš*, other related texts outside EAE measure lunar visibility in the solsticial winter night, whose length is 4 *mina* = 240 *uš*. Such a table is K 90, where the change in visibility for one night measures 16 rather than 12 *uš*.

3. One of the peculiarities of Table B lies in the fact that when it reaches the waning phase of the month on day 16 it employs the rare astronomical term *maššartu*, from *našāru*, "to wane, diminish."[55] This term may designate either the decrease of night-time lunar visibility which takes place on that day or the actual waning of the moon's light. Al-Rawi and George do not reach a conclusive decision regarding these two possibilities. We shall suggest below

[53] The geometrical progression of lunar visibility in days 1–5 and 25–29 according to Table A was noted already in ancient times. An interpretation of this progression was offered in the tablet BM 45821+ (Al-Rawi and George, "Enūma Anu Enlil XIV," 63–66); see also Hunger and Pingree, *Astral Sciences in Mesopotamia*, 46; Brown, *Mesopotamian Planetary Astronomy-Astrology*, 114.

[54] See also Brown, *Mesopotamian Planetary Astronomy-Astrology*, 114.

[55] See the detailed lexical discussion in Al-Rawi and George, "Enūma Anu Enlil XIV," 63.

(5.2.2) that this term may shed light on the enigmatic Hebrew term *dwq*, "diminution(?)" which appears in the Qumran *mišmarot* scrolls.

4. Table C of EAE 14, which constitutes an elaboration of the "water-clock formula," occasionally employs some new and interesting diction, such as in line 6:

> *ina Simani* UD.15.KAM *urru ana mūši inappal ūmū ikarrû* (LÚGUD^{meš}) *mūšū irrikū*
>
> On Simanu 15th (begins the stage when) day compensates the night. Days grow shorter and nights grow longer.

The use of the verb *napālu*, "compensate," common in economic contexts, evokes the use of the originally economical Greek expression διδόναι δίκην in the cosmological fragments of the pre-Socratic thinker Anaximander, fragment 110.[56]

To sum up, a group of astronomical sources from the early first millennium B.C.E. supply computed figures for measuring the time intervals of the moon's visibility and invisibility. These time periods are based upon the length of night time as extrapolated from the "water-clock formula" and therefore all operate within the framework of the ideal 360-day year and 30-day month, with the day length varying according to a ratio of 2:1. Although the sources are not completely identical, they yield a coherent lunar theory according to which the length of night-time lunar visibility increases as the moon waxes and decreases as it wanes, in an approximate daily ratio of $^{1}/_{15}$ of the night. The various sources of this tradition do not treat the *position* of the moon but solely its periods of visibility.

4.2 The Acceptance and Influence of Mul.Apin-type Astronomy

The type of knowledge embodied in Mul.Apin shaped the observational practices of astronomers in the Neo-Assyrian period, during which many of the extant copies of this compendium were written. Mul.Apin and EAE continued to be copied as late as the

[56] For *napālu*, see CAD N/1, s.v. *napālu* B, pp. 275–77. For the Greek verb, see *LSJ* s.v. δίδωμι mng. 6. For Anaximander, see G.S. Kirk, J.E. Raven, and M. Schofield, *The Presocratic Philosophers* (Cambridge: Cambridge University Press, 1983²), 117–21. Note also that some Greek traditions link Anaximander's name with the invention—or at least installation—of a *gnomon* (ibid, 103).

Hellenistic period.[57] The fact that ancient astronomical sources were esteemed long after they were outdated by new astronomical methods is attested by the common designation of the practitioners of astronomy (and astrology) in later times as *ṭupšar* (scribe of) *Enūma Anu Enlil* and of the corresponding discipline as *ṭupšarūtu EAE*.[58]

Mul.Apin-type astronomy was popular not only within but also outside Mesopotamia, reaching Greece, Rome, Egypt, and even India. This cultural phenomenon may either have been the consequence of direct influence from Mul.Apin or an independent development of similar astronomical rules in a variety of cultures, much of Mul.Apin constituting an efficient and "down-to-earth" account of the celestial phenomena. This fact is of seminal significance for the present work, in which concepts similar to those of Mul.Apin are traced to yet another ancient culture, namely Judaea. In this case, the signs of direct association with Mul.Apin are unmistakable. Such an influence could have been exerted anytime between the Neo-Assyrian and the Hellenistic periods. The following section briefly surveys some of the attestations of Mul.Apin-type astronomy in various cultures.

4.2.1 *Mul.Apin in Neo-Assyrian Letters and Reports*

While Neo-Assyrian reports and letters from scholars commonly refer to EAE as their source, Mul.Apin is quoted only once in a letter by Balasî and Nabû-aḫḫe-eriba (SAA X §62) and referred to in the letter SAA X §102.[59] Despite the paucity of citations, however, good reason exists to assume that Mul.Apin possessed a central place in contemporary teaching. Two Neo-Assyrian copies of Mul.apin were copied by well-known scribes in the Neo-Assyrian court.[60] Central astronomical texts of the NA period are also dependent upon its

[57] For a copy of Mul.Apin dated to King Seleucus' reign, see Hunger and Pingree, *Mul.Apin*, 9; for a still later attestation, see Hunger and Pingree, *Astral Sciences in Mesopotamia*, 63. The tablets of EAE were catalogued in Hellenistic Uruk: see E. Weidner, "Die astrologische Serie Enûma Anu Enlil," *AfO* 14 (1941/1944): 172–95.

[58] See in general, Rochberg, *The Heavenly Writing*, 219–36.

[59] The quoted line deals with the stars rising in Nisan: see *LAS II*, 31, 43, 52.

[60] The copies are VAT 8619 and VAT 9412+ (see the colophons in Hunger and Pingree, *Mul.Apin*, 123). For the scribes Nabu-rēšu-iši and Nabu-zēru-iddin, see S. Parpola et al. (eds.), *The Prosopography of the Neo-Assyrian Empire* (Helsinki: Helsinki University Press, 2001), 2:864f, 908–10.

teachings, while the instructions in the "Diviner's Manual" frequently parallel those of Mul.Apin.[61] The water-clock model for the length of daylight is reflected in the Ivory Prism from Nineveh, the sole difference between the two texts lying in the fact that the latter measures time by *bēru* rather than Mul.Apin's use of *mina*.[62] The reports of Neo-Assyrian court astronomers also frequently reflect the practice of Mul.Apin-type astronomy. Some examples regarding the central issues of these texts follow:

1. Stars. The necessity for a leap year owing to the lateness of the rising of fixed stars is proclaimed by Balasî (SAA VIII §98 rev. 8–10): "Let them intercalate a month; all the stars of the sky have fallen behind; Adar must not pass unfavourably; let them intercalate!"

2. Intercalation schemes. The term *ūmē atrūti*, "days in excess, additional days," is mentioned in several reports: SAA VIII §§167, 248, 352.

3. Length of daylight. In the NA reports, the actual length of the day was measured against the schematic length derived from the "water-clock formula." If and when the two did not match, a bad omen was predicted. A specific case in point is expanded on in SAA VIII §9 rev. 6–9: "These omens are now very [appropriate] to ci[te] in that the first days [became long] after eac[h other] regularly." The report in SAA VIII §140 specifies the ideal day length at the equinox:

> On the 6th of Nisan the day and the night were in balance: 6 *bēru* of daylight, 6 *bēru* of night.[63]

The measurements are given in *bēru*, as in the Ivory Prism, rather than in *mina* or *uš* (1 *bēru* = 30 *uš*, which equals the time of pouring of $^1/_2$ *mina* in the water clock; 6 *bēru* thus equal 6 x 30 *uš* = 180 *uš* = 3 *mina*; this is identical to the day-length dictated by the "water-clock formula").

4. Lunar phases. In the reports, the full moon regularly occurs on day 14 of the month and is reported thus to the king: "^{d}*Sin u* ^{d}*Šamaš itti ahāiš innammarū*, moon and sun see each other." Whenever the full moon occurs on a day other than the fourteenth, it is reported to the

[61] See Williams, "Signs from the Sky, Signs from the Earth."
[62] See Hunger and Pingree, *Astral Sciences in Mesopotamia*, 112–15.
[63] Cf. SAA VIII §§141, 142.

king as a bad omen (e.g., SAA VIII §§80, 88, 134). On the day following the full moon, the moon is expected to set after sunrise. A failure of this prediction is reported in SAA VIII §295 (freely translated): "If the moon does not wait for the sun to rise, [but sets beforehand]: raging of lion[s and wolves]."

Numerous reports trace the day on which the moon disappears (UD.NÁ.A, *ūm bubbuli*). According to SAA VIII §346, the moon ideally vanishes on day 27 and remains covered for a maximum period of three days. This echoes the instruction with regard to the day of disappearance in Mul.Apin II ii 11.[64] Of equal importance was the appearance of the new moon which, if observed on time, was reported by the formula: "The moon will complete the day." If the new moon was seen already on the thirtieth day, the report stated that "the moon will reject the day"—i.e., the previous month would be a hollow one of 29 days.[65]

Occasionally, the time periods between the rising and setting of moon and sun are recorded. For example, in SAA VIII §293 (a letter written several days after the full moon) the king is assured that he will be able to observe the moon in the morning for one *bēru* before it sets. SAA VIII §207 is exceptionally meticulous in its recording of lunar visibility throughout the entire first half of the month, including the length of visibility after sunrise.[66] This rare report is designated by Hunger "an early form of diary."[67]

Except for these rare pieces of evidence, the reports do not reflect any regular tracking of Lunar Six phenomena. None of them mention the two time intervals of Mul.Apin section l. In contrast to Mul.Apin and EAE, they measure the time in "watches" (*maṣṣartu*) or double hours (*bēru*) rather than in water-clock time units. Although water-

[64] See above 4.1.3.

[65] These reports were interpreted according to U. Koch-Westenholz, *Mesopotamian Astrology: An Introduction to Babylonian and Assyrian Celestial Divination* (Copenhagen: The Carsten Niebuhr Institute, 1995), 101–3. For the observation of the new moon, see also Hunger and Pingree, *Astral Sciences in Mesopotamia*, 117; B.Z. Wacholder and D.B. Weisberg, "Visibility of the New Moon in Cuneiform and Rabbinic Sources," *HUCA* 42 (1971): 227–42.

[66] Cf. also the fragmentary report SAA VIII §229.

[67] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 121f.

clock units are easily converted into double hours, the reports never mention the actual use of a water clock.[68]

4.2.2 *Mul.Apin-type Astronomy Outside Mesopotamia*

The interactions of ancient astral sciences constitute a rich mine for students of intercultural contact in antiquity. The task of identifying influences is one which demands great prudence and strict methodological considerations. David Pingree has been a prominent advocate of the existence of such intercultural relations, his work being both lauded and criticized by subsequent scholars.[69]

The contribution of Babylonian to Greek astronomy is now well acknowledged.[70] Being a collection of useful, "down-to-earth" astronomical information, Mul.Apin is frequently assumed to have played a significant part in the transmission process. Pingree has adduced the following evidence to this end. Beginning with the early period, he noted that the order of stars in Mul.Apin section c is paralleled in the *Odyssey* Books 5 and 18.[71] The extreme positions of the sun on the horizon during the year are referred to in *Odyssey* Book 15 and elsewhere.[72] Herodotus witnesses that the Greeks' use of a *gnomon* was a cultural loan from Babylonia (*Hist.* 2.109.3).[73] In a later—and thus more significant period for the present study—the tables of lunar visibility from EAE 14 and Mul.Apin are found, with a

[68] This fact is acknowledged by Brown, Fermor, and Walker, "The Water Clock in Mesopotamia," 142, who also adduce an actual usage of the water clock from such texts as diaries and eclipse reports.

[69] See primarily, D. Brown (ed.), *The Interactions of Ancient Astral Sciences* (VSAO; Bremen: Hempen, forthcoming). My article in that volume (J. Ben-Dov, "Babylonian Science in West-Semitic Sources: The Case of Qumran") gives a detailed view of the place of the Qumran sources within the broader scientific interface. See further Rochberg, *The Heavenly Writing*, 237–44.

[70] See, for example, B.L. van der Waerden, *Science Awakening II: The Birth of Astronomy* (Leiden/NY: Noordhoff/Oxford University Press, 1974), 284–324; Neugebauer, *Astronomy and History: Selected Essays*, 157–64; D. Pingree, "Legacies in Astronomy and Celestial Omens," in *The Legacy of Mesopotamia* (ed. S. Dalley; Oxford: Oxford University Press, 1998), 125–37; A. Jones, "The Adaptation of Babylonian Methods in Greek Numerical Astronomy," *Isis* 82 (1991): 441–53. For astrology, see F. Rochberg-Halton, "Elements of the Babylonian Contribution to Hellenistic Astrology," *JAOS* 108 (1988): 51–62.

[71] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 67–68.

[72] Ibid, 76–77.

[73] Ibid, 80; van der Waerden, *Science Awakening II*, 285.

certain degree of variation, in Roman sources as late as Pliny (*Nat.Hist.* 2.14.58) and the *Geoponica*, where they are sometimes designated as Babylonian schemes.[74] Finally, a general account of the astronomer's ideal capacities, which closely resembles the practices implied in Mul.Apin, appears in Apuleius' description of Thales.[75]

Pingree also marked several points of correspondence between Mul.Apin and various phases of ancient Indian astronomy.[76] In addition, an Egyptian-Hellenistic text attests to the circulation of Mul.Apin-type astronomy in Egypt during the early Hellenistic period.[77] This is approximately the period of formation of the Enochic astronomy, prior to the spread of Babylonian ACT-type astronomy in the West.

4.3 AB and Mul.Apin-type Astronomy

The presence of Babylonian knowledge in various ancient cultures sheds light on the transmission of Babylonian science to Jewish culture. The study of intercultural influences recognizes differences and similarities alike. Since inherited knowledge materialises in its new environment as part of the absorbing culture's matrix of ideas and social needs, it constitutes as much a new cultural phenomenon as an extension of the practices of the originating culture. The Jewish articulation of Babylonian knowledge was not as technically skilled as Greek or Indian usages, the deficiency being primarily expressed in the Jewish astronomers' lack of observational orientation. This meant that, as the other disciplines improved their methods of mathematical astronomy, the Jewish discipline gradually became more schematic. Thus, for example, the Jewish discipline almost completely ignored

[74] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 48–49; van der Waerden, *Science Awakening II*, 291; idem, "Babylonian Astronomy: III. The Earliest Astronomical Computations," *JNES* 10 (1951), 27.

[75] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 82.

[76] Ibid, 63, 76, 78, 80. For more details, see D. Pingree, "MUL.APIN and Vedic Astronomy," in *DUMU-E$_2$-DUB-BA-A: Studies in Honor of Åke W. Sjöberg* (Occasional Publications of the Samuel Noah Kramer Fund 11; ed. H. Behrens, D. Loding, and M.T. Roth; Philadelphia: University Museum, 1989), 439–45; idem, "Legacies in Astronomy and Celestial Omens," 130, where he discusses the use of a water clock in India.

[77] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 82–83; Pingree, "Legacies in Astronomy and Celestial Omens," 132.

the fixed stars and planets. While the schematic nature of the Jewish discipline aligns well with some indigenous Jewish notions, chiefly derived from Scripture,[78] the basic elements of the "water-clock formula" nonetheless found their way into Enochic circles and subsequently into later Qumran texts.

The following précis is based on the cumulative evidence collected by Albani and Glessmer, enhanced by Drawnel's recent contribution and the conclusions of the present chapter.[79] All the points discussed below derive directly or indirectly from the "water-clock formula" as expressed in various parts of Mul.Apin and related texts.

4.3.1 *The 360-day Year, the 364-day Year, and the Triennial Cycle*

Mul.Apin and its related texts are based on the ideal year of 360 days, which comprises 12 months of 30 days each. The year is divided into four seasons of 90 days each. This pattern is applied in Mul.Apin to the path of the stars (sections a–e), the sun (the intercalation schemes and shadow-length tables), and lunar visibility (section l and EAE 14).

Each of the above integers is expressed by a linear zigzag function which alternates with the seasons. The presence of this linear function precludes any possibility of a 91-day season, demanding instead a precisely-numbered season of 90 days. This fact also obtains with regard to the schemes of AB, where the "additional" day number 91 interrupts the flow of the functions of solar motion (chapter 72) and lunar motion (chapters 73–74, 78–79). We have demonstrated above how the change from a 360-day year to the 364DY generated numerous problems for the articulation of lunar theory in AB.

The Jewish 364DY was created by the inclusion of the four "additional days" in the yearly ephemeris. This addition constituted an "inner-Enochic" development, based on the septenary tendencies adopted by the Jewish authors. At the same time, the Jewish 364DY echoes the Mesopotamian "invention" of the same figure in Mul.Apin

[78] See J.C. VanderKam, "Scripture in the Astronomical Book of Enoch," in *Things Revealed: Studies in Early Jewish and Christian Literature in Honor of Michael E. Stone* (ed. E. Chazon et al.; JSJSup 89; Leiden: Brill), 89–103.

[79] As the discussion below refers frequently to the conclusions drawn previously in this chapter, the use of cross-references has been kept to a minimum.

II ii 11–12. Whereas in Mul.Apin the number of 364 days was limited exclusively to these lines, in AB it enhanced the composition of Type III lunar passages (e.g., *1 En* 74:10–16), in which the time gap between the 364DY and the 354-day lunar year was calculated.

A cycle of 37 lunations, known in Mesopotamia as early as the fourth millennium B.C.E., was woven into Mul.Apin's mode of thought through the "intercalation schemes." Such a cycle was reported in the Type III lunar passages of AB, probably in the original form of *1 En* 74:10–16. As demonstrated in Chapter 3, a fully-fledged application of the number 364 and the triennial cycle was introduced only in later Jewish compositions, which constituted expansions and variations on the themes of AB. The 364DY and the triennial cycle eventually became the infrastructure of calendrical speculation in the sectarian tradition.

4.3.2 *The Length of Daytime and Night Time*

1 Enoch 72 records the length of daylight and night time in each month of the year. The day is divided into 18 "parts." At the solstices, these parts are divided between day and night according to a ratio of 2:1 (longest day/night—12 parts; shortest day/night—6 parts). The progression is 3 parts per season, or 1 part per month.

As Weidner and subsequent scholars have demonstrated, the fact that the 2:1 ratio does not correspond to Judaean reality indicates that it was not devised in Judaea but probably originated in the traditional Mesopotamian system, the closest available parallel.[80] In contrast, the ancient Egyptian tradition knows a division of the daily 24 hours into day and night according to the (even less realistic) ratio of 3:1, with the extrema being 18:6 at the solstices.[81] In a few later Egyptian texts, a ratio of 2:1 is recorded—notably in first century C.E. hieratic papyri from Tebtunis, where the twelve months of the year are enumerated

[80] E. Weidner, "Babylonisches im Buche Enoch"; Neugebauer, "Appendix A," 394–95; VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*, 94–95; Albani, *Astronomie und Schöpfungsglaube*, 179–80; Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin."

[81] Attested in *p. Kairo* 86637; see C. Leitz, *Studien zur ägyptischen Astronomie* (ÄA 49; Wiesbaden: Harrassowitz, 1989), 22–23; Albani, *Astronomie und Schöpfungsglaube*, 163f.

together with the day:night relation pertinent to them.[82] Good grounds nonetheless exist to consider this as a more remote parallel than the Mesopotamian tradition. Firstly, the day:night division of 24 hours along twelve months in a ratio of 2:1 cannot be achieved using full numbers, requiring rather the use of fractions such as $10^2/_3$ or $9^1/_3$ hours. In contrast, the Enochic model only uses full numbers. Secondly, since the ratio of 2:1 is rare in Egyptian texts and appears only in very late sources, it could by no means have been sustained over a long period of time—whereas the Mesopotamian "water-clock formula" constituted standard wisdom for over a millennium.

In contrast to the 18 "parts" in AB, the length of the nychthemeron in the Babylonian scheme is 6 *mina*. The reason for the change from six to eighteen measuring units lies in the fact that 18 is the smallest possible number of "parts" that can be divided into twelve months in a 2:1 ratio employing only whole numbers. The author of passages such as chapter 72 avoided the use of fractions to denote the length of daytime. The Enochic unit called "part" (Geez *kəfl*) is thus completely detached from the actual measurement of time units using a water clock.

4.3.3 *The Gates/Paths of Heaven and the Annual Seasons*

While AB tracks the sun's position on the horizon according to the twelve gates of heaven, the first intercalation scheme of Mul.Apin employs fixed stars and constellations as markers and the second scheme the three "Paths of Heaven." All three distinct apparata trace the sun's position on the horizon at sunrise and sunset, but not at other times of the day.[83]

Although the twelve gates appear to have developed from the three Paths, both the background of the term "gate" and the origin of the number twelve remain obscure. While "gate" as the exit point of the luminaries is well attested in Mesopotamian cosmic geography, it is only found in literary texts, being absent from the scientific

[82] J. Osing, *Hieratische Papyri aus Tebtunis* (The Carlsberg Papyri 2; Copenhagen: The Carsten Niebuhr Institute and Museum Tusculanum, 1998), 1:205–6, 262–63.

[83] Earlier commentators on AB, such as Dillmann and Charles, construed the twelve gates as standing for the signs of the zodiac. This interpretation has been rejected by O. Neugebauer, *Ethiopic Astronomy and Computus* (Vienna: ÖAW, 1979), 156–61 and Albani, *Astronomie und Schöpfungsglaube*, 156–60.

literature.[84] Equally, the term "Gate of Heaven" in Gen 28:17 cannot serve as the source for the scientific use of this term in AB (*pace* Glessmer).[85] With regard to the change of numbers, it is clear that the number of twelve gates more satisfactorily accounts for the sun's position on the horizon along the year than the three Mesopotamian paths. The concept of twelve gates remains unique in the history of astronomy, continuing solely in trajectories of AB: Slavonic Enoch, Ethiopic astronomy, and a Persian–Sogdian text which, according to Tubach, is dependent on *1 Enoch* 72.[86]

Excursus: A Possible Source for the System of Twelve Gates

In light of the lack of substantial background to illuminate the background of the system of twelve gates, the following analogy may be worth mentioning. The explanation below is based on the notion that the twelve gates create six bands across the horizon, each stretching from a gate in the east to its parallel gate in the west. At the same time, when the zodiacal signs are projected eastwards and westwards on the horizon, each pair of signs is projected onto one band, producing a total of six bands.

Comparison with an analogous concept from Ptolemy's theory of music helps clarify this notion. In that part of the *Harmonics* where musical theory is aligned with elements of astronomy, Ptolemy discusses "the third … difference of heavenly movements … that of latitude" (*Harmonica*, 3.12).[87] Observing the latitude reached by the zodiacal signs, Ptolemy notes that apart from the two extrema at the solstices, the remainder of the signs are divided into opposite pairs which stand in the same latitude. In Ptolemy's somewhat awkward style: "For each one of the solstitial signs makes as it were a parallel. But the two signs standing equally apart from each of these to the other make again one and the same." This statement is clarified via the following diagram, which outlines the equator, the ecliptic, and the horizon:

[84] Horowitz, *Mesopotamian Cosmic Geography*, 266–67.

[85] Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," 280. In later Jewish literature and liturgy, the expression "gates of heaven/light" was quite common, possibly being influenced by the cosmology of AB: see CD 10:15–16 and the term שערי אור in 4Q503. The blessing at the beginning of the Jewish evening service המעריב ערבים was also possibly influenced by AB: see L. Blau, "Observations sur l'histoire du culte Juif a propos d'un ouvrage recent," *REJ* 73 (1921): 142–44; F. Perles, "Notes sur les Apocryphes et les Pseudépigraphes," *REJ* 73 (1921), 175.

[86] Neugebauer, *Ethiopic Astronomy and Computus*, 156–61; J. Tubach, "Spuren des astronomischen Henochbuches bei den Manichäern Mittelasiens," in *Nubia et Oriens Christianus: Festschrift für C.D.G. Müller zum 60. Geburtstag* (ed. P.O. Scholz and R. Stempel; Köln: Dinter, 1988), 73–89.

[87] Translations are taken from J. Solomon, *Ptolemy Harmonics*: *Translation and Commentary* (Mnemosyne Supplement 203; Leiden: Brill, 2000).

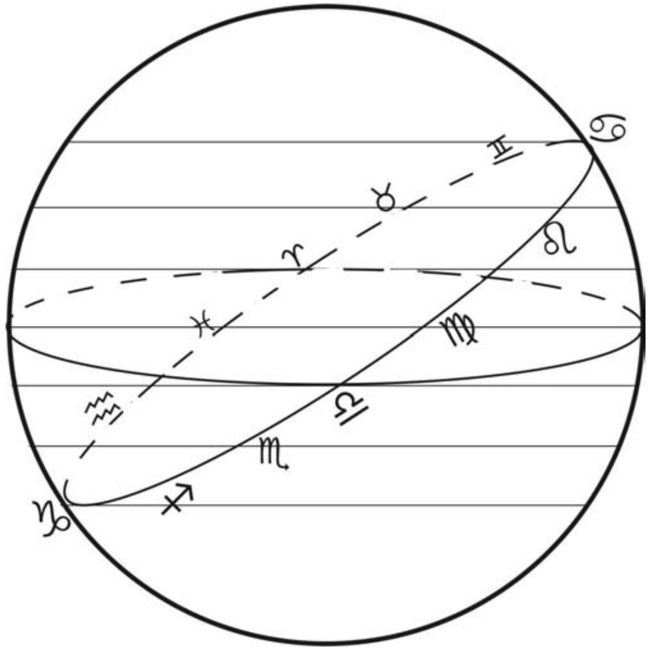

Figure 4.2: The equator, the ecliptic, and the horizon, following Ptolemy, Harmonica *3.12*[88]

Ptolemy was interested in accounting for "the modulations of the *tonoi*," seven in number. The zodiac crosses the horizon at the two extreme points of the solstices, with one zodiacal sign in each meeting point (Cancer and Capricorn). Throughout the rest of the zodiac, each sign creates a "parallel" with the sign which stands opposite it in the diagram: Gemini—Leo; Taurus—Virgo; Aries—Libra; Pisces—Scorpio; Aquarius—Sagittarius, altogether five "parallels." The total number therefore comes to the desired seven (2 solstices + 5 "parallels").[89]

We are not asserting here that AB was associated in any sense with Ptolemy, merely that the ptolemaic scheme constitutes a useful analogue for the system of twelve gates—or, more substantially, the division of the horizon into six bands. In the drawing, the projection of the ecliptic on the

[88] This drawing is modeled on I. Düring, *Ptolemaios und Porphyrios über die Musik* (Göteborg, 1934; repr. NY and London: Garland Publishing, 1980), 1:132. The angle of the ecliptic circle in the drawing is, of course, exaggerated and does not reflect the true angle of 23.5°. It is employed solely in order to emphasise the different bands.

[89] See Düring, *Ptolemaios und Porphyrios über die Musik*, 1:276f.

horizon creates six such bands, corresponding precisely to the six arcs of the horizon which constitute the gates of heaven. The diagram demonstrates how the system of twelve gates is in fact an accurate projection of the zodiacal circle eastwards and westwards. If this is true, the Enochic author who produced the system of gates may have been aware of the zodiacal signs. For some reason, however, he chose not to refer to them explicitly but rather adopted a system which reflects the ecliptical orbits of the sun and moon only obliquely, referring solely to their position on the horizon. This notion was part of the general tendency in AB, where the focus of the celestial activity appears to be the horizon rather than the ecliptic. In contrast, the *selendromion* of 4Q318 sets out the ecliptical position of the moon for every day of the year. In doing so, it clearly differs from the mode of thought represented in the Enochic literature.

One may possibly suggest that, although departing from the traditional Mesopotamian division of the "three Paths of Heaven," the Enochic system of heavenly gates took into consideration more advanced concepts arising from knowledge of the zodiacal signs.

Of special significance for AB is the description of the course of the sun according to the second intercalation scheme (Mul.Apin II Gap A 1–7; see above 4.1.3):

> From the 1st of Adar to the 30th of Iyar, the Sun travels in the Path of Anu; breeze and warm wea[ther]. From the 1st of Sivan to the 30th of Av, the Sun travels in the Path of Enlil; harvest and heat. [Fr]om the 1st of Elul to the 30th of Araḫšamnu, the Sun travels in the Path of Anu; breeze and warm weather. [From the 1s]t of Kislev to the 30th of Ševat, the Sun travels in the Path of Ea; cold weather.

This short passage highlights the link between the sun's position and the weather conditions in each of the seasons. This association concurs with the general interest of such divinatory literature as EAE in the weather conditions which accompany the portentous phenomena in heaven. A large part of EAE is devoted to omens of Adad, the weather and storm god. The reports consistently state the type of wind which was blowing when a portentous omen occurred (cf. SAA VIII §§44, 66, 79). Mul.Apin also demonstrates an interest in the weather in section h (II i 25–37 and 68–71), where the heliacal risings of stars are interpreted according to the type of wind which was blowing when they occurred. In addition, these passages also delineate the standard Mesopotamian association of certain stars with the four compass points.[90]

The correspondence between the quadruple division of the year and weather conditions also appears in parts of AB such as *1 En* 82:15–19:

> At the beginning of the year Melkeyal rises first and rules—the one called the southern sun … These are the signs of the days that are to be seen on the earth during the days of his rule: sweat, heat, and sadness (var: calm);[91] all the trees bear fruit and leaves come out on the trees; (there is) a harvest of wheat, roses, and all the flowers that bloom in the field; but the winter trees are dried up …
>
> A second leader after him is Helemelek who is named the bright sun … These are the signs of the days on the earth: heat, drought, trees bearing their fruit ripe and yielding all their fruit ripe and ready; the sheep mate and become pregnant; people gather all the fruit of the earth and everything in the fields and the winepress …

A description of the following season is fragmentarily preserved in Enastr[d] (4Q211 i):

> …] and rain falling upon the earth. And seed […] herbs of the earth and trees. And (the sun?) exits and enters […] and it is winter. And the leaves of all the trees […]een trees for which it is not fitting […] their [l]ea[ve]s remain […[92]

Although considerably more developed than the laconic language of Mul.Apin, the agricultural, rural ambiance of *1 Enoch* 82 reflects a similar interest in weather conditions and the sun's position on the horizon. Even more pronounced is the place of the winds and the compass points in *1 Enoch* 76–77, two chapters which do not appear to correspond to the astronomical interests of the remainder of AB.[93] In fact, however, these meteorological sections form an integral part of the worldview of both the Enochic and the Babylonian compositions. We have suggested above that chapters 76–77 constituted parts of the cosmological treatises included in AB. These

[90] See Albani, *Astronomie und Schöpfungsglaube*, 226–33; Horowitz, *Mesopotamian Cosmic Geography*, 175–77, 193–207; cf. also *b. ʿErub*. 56a.

[91] See the note by M.A. Knibb, *The Ethiopic Book of Enoch* (Oxford: Clarendon, 1978), 2:190; Uhlig, *Das äthiopische Henochbuch* (JSHRZ V, 6; Gütersloh: Gütersloher Verlaghaus Gerd Mohn, 1984), n. to 82:16.

[92] The translation is Milik's, slightly modified and with most of the reconstructions omitted.

[93] See VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*, 98–99.

treatises thus spanned a wide range of the cosmos, including astronomical, geographical, and meteorological interests.

Finally, we should relate briefly to Glessmer's interpretation of the heavenly gates. Above (4.1.4), we noted that Glessmer understood section k of Mul.Apin as a "clock" measuring time by arcs of the horizon. These arcs correspond to the heavenly gates of AB. This notion is linked to Glessmer's application, in a separate article, of Mul.Apin to the sundial found at Qumran.[94] According to Glessmer, this artifact and the above-noted textual sources—Mul.Apin sections g and k and *1 Enoch* 72—all attest to a common method of expressing the time of the day by arcs on the horizon. The twelve Gates of Heaven are thus, in his eyes, far from being a schematic concept; rather they are a reliable expression of the sun's azimuth, which enhances the use of a highly accurate sundial.

We have already demonstrated above that the measuring of time by arcs on the horizon is foreign to Mul.Apin. Such a concept is also remote from the mode of thought of AB. There is no sign within AB that the data on the sun's position at sunrise and sunset—employing the systems of Gates of Heaven—was elaborated in order to measure small-scale time periods. On the contrary, no short time units such as hours or minutes are mentioned in AB, the author appearing to avoid this kind of temporal measurement throughout the entire composition.

4.3.4 *Lunar Visibility*

In Chapter 2, we surveyed the aspects of lunar theory covered in the various versions of AB. Having clarified the place of the theory of lunar visibility within Mul.Apin, we may now draw a more comprehensive picture of the place occupied by the lunar visibility passages in Mul.Apin and AB.

Mul.Apin section l and EAE 14 measure the time intervals of daytime and night time lunar visibility on various dates. Generally speaking, these time intervals increase or decrease at a daily rate of $^1/_{15}$ of the night/day. Taking into account the length of each night of

[94] U. Glessmer and M. Albani, "An Astronomical Measuring Instrument from Qumran," in *The Provo International Conference on the Dead Sea Scrolls* (STDJ 30; ed. D.W. Parry and E. Ulrich; Leiden: Brill, 1999), 407–42; Glessmer, "Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin," 273–78.

the year according to the "water-clock formula," EAE 14 divides this data by 15, thereby producing concrete figures for the length of every such time interval. It should be noted that the moon's position is not discussed at all in the above-mentioned sections, which speak only of the time of its rising and setting.[95] Nor do the sections on lunar visibility in Mul.Apin and EAE relate to the sun's position on the horizon in the indicated months but relate exclusively to lunar theory. The modern reader may assume that a good practitioner of Mul.Apin-type astronomy would have possessed the ability to extrapolate from one section of Mul.Apin to another and produce an integrated picture of the heavenly luminaries.

Following Drawnel's new interpretation of the "Expanded Model of Lunar Visibility" (EMLV, formerly known as "The Synchronistic Calendar"),[96] we are now able to view this Aramaic document as yet another variation on the water-clock model of Mul.Apin. The heart of EMLV is devoted to measuring the length of lunar visibility along the lines of EAE Tables A and B. In contrast to EAE, however, the lunar data in EMLV are accompanied by data on the position of the moon and sun on the horizon, employing the Enochic system of the twelve heavenly gates. The EMLV may thus be said to constitute a combination of data from Mul.Apin sections j and l, plus additional data regarding the moon's position as it rises during the month. The latter data not being present either in Mul.Apin or in EAE, it most probably constitutes an "innovation" on the part of the Enochic author. Indeed, in terms of tradition history the source of this piece of data requires further investigation.

In similar fashion to Tables A and B in EAE 14, the various versions of AB mark the days of the new moon, full moon, and last visibility as key points in the course of the month. These key points divide the schematic lunar month into two parts—waxing and waning—with lunar visibility in the first half taking place primarily during the day and the moon being seen primarily at night in the second half. Descriptions of the key points are preserved throughout AB. The dark and new moon are mentioned in 73:7:

[95] While section f of Mul.Apin lists the constellations on the path of the moon, it does not indicate how the moon's position within these constellations at any given moment may be deduced.

[96] H. Drawnel, "Moon Computation in the *Aramaic Astronomical Book*," *RQ* 23 (2007): 3–41. For the designation "EMLV," see above 2.1.

> It sets with the sun, and when the sun rises it rises with it and receives a half part of light.

According to this verse, the dark and new moon "appear" in proximity to sunrise and remain in the sky—although not visibly—for the length of the entire day. This text may be compared to the description of day 30 in EAE 14 Table A: "The god stands during the day."

The full moon is described in 78:13:

> It is complete precisely on the day the sun sets in the west, and it rises from the east during the night, and the moon shines during the entire night, until the sun rises in front of it …

Generally speaking, it may therefore be said that the lunar-visibility schemes of EAE 14 and AB are based on a similar plan. In contrast to the Mesopotamian sources on lunar visibility, however, the EMLV assigns no concrete measures to the time intervals. They are rather measured as $^1/_7$ or $^1/_{14}$ parts of the night. Whereas Tables A and B of EAE pertain only to the equinoctial month, and the tablet K 90 pertains only to the solsticial night, the data in the EMLV may be easily applied to any month of the year, comprising as it does relative rather than absolute data. The reason behind this divergence lies in the simple fact that the EMLV does not record the actual length of daytime and night time. This piece of data—which in Mul.Apin is expressed by the "water-clock formula"—is present in AB only in *1 Enoch* 72, where it takes the form of relative rather than absolute "parts" of the nychthemeron. We may therefore conclude that the Enochic author of AB was not interested in measuring absolute periods of time with time-measuring devices. Secondly, the parts of AB which stand outside the EMLV (such as the Geez chapters) supplement the data contained in that core composition. The long Aramaic treatise on lunar visibility was not intended to stand on its own but in conjunction with other passages covering additional cosmological phenomena.

Another revealing difference between the Mesopotamian and Enochic traditions lies in the change from fifteen phases of lunar visibility in EAE to fourteen such phases in AB. The reason for this change may possibly lie in AB's Jewish background, which gave precedence to septenary numbers as part of the Jewish conception of sacred time. The comparative chart produced by Pingree, where the lunar visibility data of EAE 14 is compared with five (!) different sets of data from Roman sources, from Pliny to the *Geoponica* is instructive in this regard.[97] While all these sources are initially derived from EAE 14, each of them employs an adaptation (or in Pingree's words "degradation") of the original. In this sense, the lunar visibility data of EMLV should be included in the same table as a typical Jewish adaptation of the Babylonian source.

Note should also be made of the specific lunar phenomena measured in the various sources. The Mesopotamian sources only measure the period of lunar visibility/invisibility. Somewhat divergently, the Aramaic EMLV additionally includes brief statements on the amount of light on the moon's surface. Later versions of AB—both Aramaic and Ethiopic—appear to have gradually abandoned the measuring the length of lunar visibility in favour of an exclusive focus on the moon's light. The latter data is, of course, more simple and mundane than the measuring of periods of lunar visibility. 4Q317, which constitutes a sectarian variation on the lunar tables of AB, possibly also reflects this trend.

We have noted above that while Tables A–B of EAE 14 relate to a single month, Tables C–D relate to the entire schematic year. This distinction is equally valid with regard to the lunar passages in AB, as the following diagram indicates:

	EAE 14	AB
Monthly Focus	Tables A, B	73; 78:1–9; 78:10–14, 17
Yearly Focus	Tables C, D	74; 78:15–16; 79:3–5

4.3.5 *The Stars*

Heliacal risings of fixed stars cover the entire first tablet of Mul.Apin, approximately half of its text. This element of Mul.Apin's teaching remained prominent in the various cultures to which this knowledge was subsequently transmitted: Greece, Egypt, India, etc. We must now ask whether the same is true with regard to AB, and if the answer is negative, whence the reason for the disparity.

[97] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 49.

The primary textual attestations of AB—EMLV and chapters 72–74, 78–79—generally ignore the stars, focusing their attention largely on the sun and moon. The stars are only mentioned briefly in scattered references: 74:11; 75:1–2, 4–9; 79:5; 80:5.[98] A somewhat longer discussion of the stars is preserved in chapter 82 and in the Aramaic passage 4Q211 ii–iii. This short passage immediately follows 4Q211 i, which belongs to the end of chapter 82. In direct contrast to the star catalogues of Mul.Apin, except for one obscure reference to the Wagon in 75:8–9 not one star is mentioned by name in any of these stellar references.

Despite the meager evidence, the authors of AB appear to have been clearly aware of the concordance between the course of the schematic year and the positions of important fixed stars. The stars are associated with the sun and the moon in the following verses:

> 74:11 The extra amount for the sun and stars comes to six days … and the moon is thirty days less than the sun and the stars.
>
> 75:3 … the sun, the moon, the stars, and all the serving entities that go around in all the heavenly chariots.
>
> 79:5 It (the moon) falls behind the sun and the law of the stars five days exactly in one period.
>
> 80:4–7 The moon will change its order and will not appear at its (normal) time. At that time … it will shine very much more (brightly) than (its) normal light. Many heads of the stars will stray from the command and will change their ways and actions, and will not appear at the times prescribed for them. The entire law of the stars will be closed to the sinners …

Whereas the authors of AB acknowledged that the stars reflect the march of Time in similar fashion to the sun and moon, they chose to assign them less prominence in their actual calculations. Another paragraph on the role of stars gives their key positions "one in the first gate, one in the third gate, one in the fourth, and one in the sixth" (82:6 = 75:2)—i.e., the stars stand at the four key-points of the year.[99] With Mul.Apin in mind, we may suggest that the four quarters of the

[98] We have not included 74:12 here, as the stars only appear in it if one accepts Charles' emendation (see above 3.2).

[99] For the similarity between 75:1–3 and 82:4b–8, see above 2.3.

year are marked here by certain fixed stars in accordance with the indication of the sun's position on the horizon in the first intercalation scheme. Further, in correspondence with Mul.Apin the passages dealing with the stars in AB are associated with sections on the weather conditions during the year (cf. the connection of 75:1–3 with 75:4–9). We may consequently assert that, despite the relative absence of stars in AB, they constitute a central place in the year's structure in much the same way as in Mul.Apin.

A single Enochic passage preserves calculations related to the stars. It stands at the end of the fragment 4Q211 (columns ii–iii), whose first column (i) parallels the ending of the present AB in chapter 82. While this short fragment fails to mention star names, its relation to the stars is ascertained by line ii 4, which is reconstructed to read:

וכוכ[בין] נזחו בׄ[תרעי] שמיׄא קד]

and sta[rs] move through the fi[rst? gates] of heaven[100]

A series of days follows, with numerical figures—mainly fractions—appended to each day. Although the text is very fragmentary, some sense can be derived from the fractions. In line ii 3, the denominator 9 is employed in the number 1/(10 x 9) = $^1/_{90}$, with no day specified. A series in decreasing order follows in lines ii 5–6 for days 1–3 (of an unspecified month?). Here the denominator used is 6:

Day 1	1/(6 x 10) = $^1/_{60}$
Day 2	1/(6 x 15) = $^1/_{90}$
Day 3	1/(6 x 30) = $^1/_{180}$

In column iii, the denominator changes back from 6 to 9, with the fractions 1/(3 x 9) = $^1/_{27}$ (line iii 5) and $^1/_{90}$ appearing in line iii 6.

[100] J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976), 296–97. Milik's reconstruction of the end of the line as קד]מיא is problematic, since it is difficult to understand what the "first gates" are and what other gates exist that are not the "first." Although the phrase may possibly relate to the account of the gates for the stars in 75:6–9, the latter account does not provide any details concerning the distinction between or numbering of the gates. Alternatively, one may restore the missing phrase in the singular: וכוכ[בין] נזחו ב[תרע] שמיא קד]מאה "and sta[rs] move through the fi[rst gate] of heaven."

Several interpretations of this fragment have been suggested.[101] Milik has proposed that it measures the daily movement of stars, $^{1}/_{90}$ expressing a daily movement of 4° (cf. Mul.Apin I iii 49–50). This explanation fails to account for the fractions smaller than $^{1}/_{90}$, however. Neugebauer understood the denominators 6 and 9 as referring to the mean "part" of a day, according to the table in *1 Enoch* 72, where the day measures 6 parts at the winter solstice and 9 parts at the equinox. According to Neugebauer, the fractions in 4Q211 convey a precise division of the parts into "minutes" (Eth. *kekros* = $^{1}/_{30}$ of a "part").

Albani has further elaborated on this idea, paying special attention to the statement concerning the stars in ii 4. He explains the fragment as an attempt to correlate the sun's position—determined according to the plan of chapter 72—with the visibility phases of fixed stars. If this interpretation is correct, the Qumran fragment may be seen as anteceding the concepts of "steps" for the sun,[102] or *paranatellonta*.[103] Although this fragment evidently demands closer study, both philological and scientific, it clearly forms part of the Mul.Apin-type astronomical teaching.

4.4 Conclusion: AB and Mul.Apin-type Astronomy

The above discussion has corroborated the claim of cultural contact between AB and Mul.Apin-type astronomy. In their own, somewhat simplistic, way the sections of AB elaborate on various branches of the "water-clock formula." The branches developed in AB are:

[101] Milik, *The Books of Enoch,* 297; Neugebauer, *Ethiopic Astronomy and Computus*, 169; Albani, *Astronomie und Schöpfungsglaube*, 61–66.

[102] Note that the function alternates according to an interval of 15 days. On the "steps," see Neugebauer, *HAMA*, 669–71.

[103] Neugebauer, *HAMA*, 760–63; Albani, *Astronomie und Schöpfungsglaube*, 62 n. 67. Albani's proposals raise a series of unanswered challenges. Firstly, one cannot ignore the fact that not a single star is mentioned by name in the passage. This is presumably the reason why Neugebauer adopted a more modest interpretation, downplaying the role of the stars. Although Albani assumes that the numbers in 4Q211 ii–iii measure the time interval between the rising of a month's star and sunrise, no such count appears in Mul.Apin or its related literature. On the other hand, his hypothesis that the passage deals with the visibility of stars finds some support from *1 En* 75:8–9, a passage on the circumpolar stars which may constitute a remnant of a longer treatise on stellar visibility.

The 360-day year

The length of daytime and night time

The sun's position on the horizon

Lunar visibility

Wind directions and weather conditions

Especially remarkable is the elaboration of lunar visibility in the Aramaic fragments of EMLV. The emphasis on lunar visibility carries over into the following chapter of the present volume, since this branch of schematic astronomy was further developed in Qumran sources later than AB.

The teaching of Mul.Apin—or independent theories which resemble it—spread through the entire ancient world, from Greece to India. The process of transmission began prior to the rise of the Persian Empire and was especially prevalent during its sway. It also continued into the Hellenistic-Roman period. The acceptance of Mul.Apin by Jews constitutes a special case in this cultural process. The Jewish "astronomers" emulated Mul.Apin's teaching as part of their religious worldview, adapting it to fit their unique needs by fashioning a more schematically-oriented discipline characterized by a specific emphasis on heptadic-based numbers. Likewise, the Jewish reluctance to assign significant roles to the stars led to the fact that Mul.Apin sections a–f scarcely reverberate at all in AB and its Jewish descendants.

CHAPTER 5

LUNAR PHASES IN THE *MIŠMAROT* SCROLLS AND LATE BABYLONIAN ASTRONOMY

Three *mišmarot* scrolls exist which record lunar phases during a sexennial cycle.[1] The lunar data forms an integral part of the *mišmarot* corpus in general, appearing alongside other typically Jewish elements of the calendrical tradition such as festivals and priestly courses. Three central concepts appear in the combined evidence provided by these particular scrolls:

(a) an unnamed lunar phenomenon, designated "X" by modern scholars

(b) the number of days that have passed since the previous X

(c) a lunar phenomenon named *dwq*[2]

None of the three items are mentioned together in any one scroll. 4Q320 records items (a) and (b), while 4Q321 and 4Q321a refer to (a) and (c). All three lunar texts connect the lunar phases to the 364DY, the year beginning simultaneously with the lunar phenomenon X. Since the 364DY begins at the spring equinox (cf. *1 En* 72:6, 75:2), the lunar texts from Qumran tie the lunar phases to the schematic march of the seasons. Following a general analysis of the pertinent Qumran manuscripts, we shall investigate the lunar data contained in them in detail.

[1] *Mišmarot* is the common Hebrew term for the priestly courses which served in the Temple. For the meaning of the term and data on periods of service, see U. Glessmer, "Calendars in the Qumran Scrolls'," in *The Dead Sea Scrolls After Fifty Years* (ed. P.W. Flint and J.C. VanderKam; Leiden: Brill, 1999), 240–43; J. Ben-Dov, "Mishmarot," in *Dictionary of Early Judaism* (forthcoming, with the bibliography cited there); and in great detail, U. Glessmer, *Die ideale Kultordnung: 24 Priesterordnungen in den Chronikbüchern, den kalendarischen Qumrantexten und in synagogalen Inschriften* (Habilitationschrift, Hamburg University, 1995).

[2] The current interpretation of lunar phases in the *mišmarot* texts differs from that presented in DJD XXI, 30–34. It will be illuminated further below.

5.1 A Description of 4Q320, 4Q321, and 4Q321a

5.1.1 *4Q320*

This scroll is dated, on the basis of its script, to the end of the second century B.C.E. (125–100).[3] It is the oldest of the calendrical scrolls. The penmanship is relatively good: letters are executed similarly throughout the scroll and the scribe used fixed spaces between the lines and columns. 4Q320 does not display any distinctive Qumran scribal practices—such as, for example, full orthography or multiple corrections.[4] A peculiar trait of this scroll is the variable quality of its parchment. While frags. 1–2 are penned on normal-sized good quality sheets of parchment, other fragments attest to parchment of inferior quality. 4Q320 also contains some of the narrowest columns in the entire Qumran corpus, several of which appear singly on an extremely narrow piece of parchment. Column 3 i contained no more that 17 letter-spaces in each line (based on the nearly complete line 12). The composite frg. 4 comprises several exceptionally narrow columns—such as column 4 ii, the width of whose lines is no longer than fourteen letter-spaces. Frg. 4 was created from three separate pieces of parchment, each of which contains two narrow columns—or even a single narrow column, as in the case of 4 iii. This circumstance suggests that 4Q320's scribe possessed only limited resources at his disposal, compelling him to assemble low-quality pieces of parchment.[5]

4Q320 is the longest and most elaborate of the *mišmarot* scrolls, rivaled only by the wealth of material in 4Q319. It is a compendium of various calendrical lists, only one of which relates directly to the lunar phases; other lists pertain to the festivals, lengths of months, and *otot*—i.e., solar-lunar concordances occurring at the beginning of each triennial cycle. 4Q320 is unique in its insertion of short literary passages into the calendrical lists. Such a passage occurs elsewhere only at the beginning of the *otot* list in 4Q319—i.e., at the transition

[3] See DJD XXI, 41; F.M. Cross, "The Development of the Jewish Scripts," in *The Bible and the Ancient Near East: Essays in Honor of W.F. Albright* (ed. G.E. Wright; NY: Doubleday, 1961), 138.

[4] E. Tov, *Scribal Practices and Approaches Reflected in the Texts Found in the Judean Desert* (STDJ 54; Leiden: Brill, 2004), 262.

[5] See Tov, *Scribal Practices*, 80. The situation is similar in other calendrical scrolls, such as 4Q323 and 4Q329a.

point between the *Serek* material of 4Q259 and the calendrical list.[6] These literary passages employ a different vocabulary from the technical terminology adopted in the remainder of the scroll. They frame the lists in a literary setting and appear to have served as introductions or conclusions to the various types of calendrical lists included in the scrolls—lunar texts, festival calendars, beginnings of months, *otot*, etc.

The content of 4Q320 is as follows:

1 i 1–5	Literary prologue
1 i 6–2 14	Lunar list of X dates
3 i	Literary passage mentioning *otot*
3 ii 8–11	Literary Passage
3 ii–4 i	Lengths of months and the *mišmarot* heading them
4 ii	Literary passage
4 iii–vi	Festival calendar according to *mišmarot* in a sexennial cycle

Several smaller fragments are more difficult to classify. Frgs. 5 and 7 mention the word *otot* but are hard to reconstruct. They may possibly have stood between frgs. 2 and 3, preceding the mention of *otot* in 3 i. Eibert Tigchelaar has noted that frg. 9 is in fact part of 4Q209 and was erroneously included in 4Q320.[7]

Since the reference to Creation within the literary passages of 4Q319 and 4Q320 has frequently been considered to constitute evidence for the identification of the lunar phases in the scrolls, we shall treat these passages in detail below.

[6] 4Q319 and 4Q320 also share similarities in subject matter, since the *otot* phenomena of 4Q319 occur at the beginning of every fourth year, on a date which by definition also constitutes a day of the lunar phenomenon X.

[7] E.J.C. Tigchelaar, "Miniscula Qumranica I," *RQ* 21 (2004), 644.

5.1.1.1 *Creation in 4Q319 and 4Q320*

In this section, we shall discuss the pertinent passages from 4Q319 and 4Q320. Although similar passages may possibly also have been included in 4Q321 and 4Q321a, the initial columns of these scrolls have unfortunately perished.

4Q320 1 i 1–5

1 ◦[ ]לׄהראותה מן המזרׄח

2 [לׄ[א]י֯רׄהׄ]
[ב]מׄחצׄית השמים ביסוד

3 [הבריא]הׄ מערב עׄד בוקר ב 4 בשבת

4 [ג]מׄ֯וׄל לחודש הרישון בשנה

5 [הרישו]נׄ֯הׄ֯ *vacat*

1[…] to its being seen from the east

2] to[sh]ine[in] the meridian (lit. “middle of the heavens”)[8] at the foundation of

3 [Creatio]n from evening until morning on the 4th (day) of the week (of service)

4 [of Ga]mul in the first month in year

5 [the fir]st (= the first year) *vacat*

Selected Notes on Readings

Line 2. The word [לׄ֯[א]י֯רׄהׄ] was written superlinearly and preserved in a highly fragmentary state. The reading is not contested, however.
Line 3. Wacholder and Abegg preferred the reading ביסוד [הרקי]ע—probably following the *Handkonkordanz*.[9] Astronomically, this reading seems preferable, “the foundation of Heaven” being cognate with the Akkadian term *išid šamê* “horizon.”[10] The traces of script after the lacuna most probably suggest the letter *he*, however.[11]

[8] For this translation, see T. Langerman, “A Great Light in Midheaven,” *Meghillot* 4 (2006), 203 (Hebrew).

[9] B.Z. Wacholder and M.G. Abegg, *A Preliminary Edition of the Unpublished Dead Sea Scrolls: The Hebrew and Aramaic Texts from Cave Four* (Washington, D.C.: Biblical Archaeology Society, 1991), 1:60.

[10] W. Horowitz, *Mesopotamian Cosmic Geography* (Winona Lake, IN: Eisenbrauns, 1998), 233–35.

[11] See DJD XXI, 43. *4 Ezra* 6:38 should be added to the references cited there.

4Q320 3 i 9–13

9]○ שני הקדש

10 ה]בֿריאה קדש

11 ב] 4 בֿשבת

12 גמו]לֿ רֿ[ו]ש כל השנים

13 את]וֿתֿ היובל השני

9] the years of holiness

10 the] Creation holy

11 on the 4]th (day) in the week

12 of Gamu]l, he[a]d of all the years

13 *ot*]*ot* of the second jubilee

4Q320 3 ii 9–11

9 בזבחיֿ[ם

10 ימים ○[

11 קדש

9 with(?) sacrifice[s

10 days [

11 holy [

4Q320 4 ii 10–14

10 הימים ולשבֿתת

11 לחדשים

12 [ול]שֿנים ולשמטים

13 וליובלֿות ב 4

14 בשבת בני גמול

10 the days and for the Sabbaths

11 for the months

12 [and for the] years and for the seven-year periods

13 and for the jubilees. On the 4th (day)

14 in the week of the sons of Gamul

4Q319 IV 10–11

10]אורה בארבעה בשבׄ]ת

11 ה]בׄריאה בארבעה בׄגׄ]מול

10]its light (came forth) on the 4th (day) of the wee[k

11 [the] Creation. In the 4th (day) in Ga[mul

These passages share several themes. Most evident are various derivations from the root אור "light." The units also contain references to the date "fourth (day) of the week of Gamul."[12] This date marks the beginning of the triennial and sexennial cycles and also constitutes the very foundation of Time in the created world. It is hence called "h[e]ad of all the years." Creation thus emerges as the key concept of the literary passages embedded in the calendars.[13]

The date "fourth day of Gamul" simultaneously opens the triennial cycle and constitutes the date of the first X phenomenon in 4Q320. 4Q319 develops this notion by fixing an *ot* or "sign" to the beginning of each new triennial cycle, assigned to the priestly course currently serving—always either Gamul or Šekaniah. Taken together, 4Q319 and 4Q320 thus lay special stress on the constellation of the heavenly luminaries at the time of Creation. Each recurrence of the original constellation reenacts the process of Creation. A similar concept is also found in the rabbinic calendrical tradition, where the basic calendrical unit is not the Qumran sexennial cycle but an intercalary cycle of 19 years. Each such cycle contains 19 x 12 + 7 = 235 months. According to the later Jewish discipline, the fact that each month begins with the *molad* (conjunction) enables the time of the latter to be computed retrospectively for any given month, based on the number of 19-year cycles which have passed since the first *molad* of Creation

[12] For the translation of שבת as "week," see B.Y. Schwarz, "Šabūʿa, šabûʿôt and Seven Weeks," *Tarbiz* 65 (1996): 189–94 (Hebrew).

[13] It should be noted that Creation is also mentioned in 4Q319 IV 17 at the end of the first jubilee included in the *otot* list. The author apparently sought to depict each new jubilee as a reenactment of Creation, although it is not clear why Creation was not mentioned following other jubilees in this cycle (cf. DJD XXI, 216).

(מולד בהר״ד).[14] The total number of months since Creation is divided by 235 to discover the number of complete 19-year cycles, the remainder being considered to constitute the distance of the present month from the original *molad* of Creation. In this way, the beginning of each new 19-year cycle is conceived as the reenactment of Creation.

A similar calculation is also carried out with regard to the creation of the sun. This event having taken place at the first spring equinox (תקופת ניסן), the recurrence of the spring equinox after a fixed cycle of years is considered to constitute a reenactment of Creation.[15]

We thus see how Qumran and later Jewish calendars alike sought to link the first *tequfah* to the creation of the luminaries.[16] The fictitious dimension in the association of the *tequfah* calculations with Creation was acknowledged by an early medieval Gaon: "With regard to your question on בהר״ד, according to which you act, (this issue) is not anchored in world history but is a concept created by bookeepers (חשבנין), each one according to what fits his opinion. One should not attempt to learn world history from these speculations (חשבונות) …"[17]

[14] A. Halevi Frankel, s.v. לוח, *Encyclopaedia Hebraica*, 21:346; A. Akavia, *The Calendar and its Chronological Use: A Reference Book for Technical and Historical Chronology* (Jerusalem: Magnes Press, 1953), 10–11 (Hebrew). On the somewhat similar theme of *thema mundi* in Byzantine compositions, see M.O. Wise, *Thunder in Gemini and Other Essays on the History, Language and Literature of Second Temple Palestine* (JSPSup 15; Sheffield: Academic Press, 1994), 39–41.

[15] Akavia*, The Calendar and its Chronological Use*, 21–22, 25. Jewish liturgy has preserved a special service, known as ברכת החמה, performed every 28 years when the *tequfah* of Nisan falls on the same day of the week and the same hour as in the first equinox of Creation.

[16] Two systems exist for the calculation of *tequfot* in the Jewish calendar: see in detail, H.Y. Borenstein, "The *tequfot* and their Development," in *S.A. Poznanski Memorial Volume* (ed. S. Simonsohn et al.; Warsaw and Leipzig: Harrassowitz, 1917), 33–58 (Hebrew); Akavia, *The Calendar and its Chronological Use*, 19–25; S. Stern, "Fictitious Calendars: Early Rabbinic Notions of Time, Astronomy and Reality," *JQR* 87 (1996): 103–29. Curiously, one of these systems resembles the lunar reckonings used at Qumran. According to the *tequfah* of Rav Ada, the first equinox occurred around nine hours before the first *molad* of Nisan—i.e., on 27 Adar. It follows that the creation of the sun at the equinox point occurred in very close proximity to the last visibility of the moon in the hypothetical month prior to Creation. This unique constellation corresponds to the interpretation suggested below for the identity of the lunar phenomenon X in 4Q320.

[17] B.M. Lewin (ed.), *Otsar ha-Gaonim: Thesaurus of the Gaonic Responsa and Commentaries*, Vol. V, 3: Tractate Roš Haššana (Jerusalem: The Hebrew University Press Association, 1932), 19.

The *mišmarot* texts establish the order of the priestly courses as an authoritative method of time reckoning. According to the data contained in these scrolls, the order of the priestly courses was sanctified on the day the luminaries were created, which also constituted the day on which the march of Time commenced. (In fact, the course of Gamul was in the middle of its service when the luminaries were created.) Dates linked to the *mišmarot* appear side by side with those standard in the 364DY. In this way, the *mišmarot* are made to constitute an inherent marker of the march of Time, equal to the orbits of the heavenly luminaries.

The fact that the *mišmarot* count was regarded as rooted in primordial times gave rise to an early link between Creation and the Temple. This association already appears in biblical literature and is expanded in *piyyutim* and other compositions from the talmudic period.[18] The Qumran material reflects a similar interest, constituting a pre-rabbinic attestation of the link between myth and ritual. Rabbinic literature developed this theme—evidenced, for example, in such statements as *m.* *ʾAbot* 1:2: "Upon three things is the world based: upon the Torah, upon Temple service, and upon the practice of charity." When the non-priestly cycle of *maʿamadot* was established as a substitute for the priestly *mišmarot*, it absorbed the Creation imagery. This is reflected in the assignment of the creation narrative in Genesis as the portion read by the *maʿamadot* (cf. *m. Taʿan*. 4:3). It is further confirmed by a talmudic statement: "Were it not for the Maʿmadot heaven and earth could not endure" (*b. Taʿan*. 27b).

The literary passages in 4Q320 assume that time reckoning based on the *mišmarot* was practiced prior to the existence of the Temple and the rise of the priestly families. This concept corresponds to the teaching in the *Book of Jubilees*, according to which three central religious institutions were observed by the heavenly angels before they were ordained at Sinai: the Sabbath (*Jub* 2:17–21), circumcision

[18] For biblical and ANE sources, see B. Janowski, "Tempel und Schöpfung: Schöpfungstheologische Aspekte der priesterschriftlichen Heiligtums Konzeption," in *Gottes Gegenwart in Israel: Beiträge zur Theologie des Alten Testaments* (Neukirchen-Vluyn: Neukirchener, 1993), 214–46. For later Jewish sources, see M.D. Swartz, "Ritual about Myth about Ritual: Towards an Understanding of the *Avodah* in the Rabbinic Period," *JJTP* 6 (1997): 135–55. On *piyyutim* of the *ʿavodah* type, see J. Yahalom, *Poetry and Society in Jewish Galilee of Late Antiquity* (Tel Aviv: Haqibutz HaMeʾuhad, 1999), 10–136 (Hebrew); M. Kister, "5Q13 and the *ʿavodah*: A Historical Survey and Its Significance," *DSD* 8 (2001): 136–48.

(15:27), and the Festival of Weeks (6:17–18). It is even possible that the authors of the calendrical texts understood the *mišmarot* order as being maintained in heaven by groups of angels representing the priestly courses.

The authors of the calendrical lists placed special stress on the day of Creation as commemorating the natural order before it was corrupted by human sin, the introduction of the latter interfering with and distorting the ideal scheme (cf. *1 En* 80:2–8).[19] The impact of sin on the natural order constitutes a central object of reflection in *1 Enoch*, primarily in the introductory chapters (2–5), but also in the Book of Watchers and AB.[20] It is further mentioned in the wisdom texts from Qumran, and continuing as a theme also in sectarian literature.[21] Some ancient authors held that the original state of events will be restored in the future "new Creation" (*Jub* 1:29, 5:12).[22] Descriptions of the luminaries in Second Temple literature thus attained an eschatological dimension, in line with the prophecy in Isaiah: "And the light of the moon shall become like the light of the

[19] For this passage, see M. Albani, *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch* (WMANT 68; Neukirchen-Vluyn: Neukirchener, 1994), 108–34; J.C. VanderKam, "1 Enoch 80 within the Book of the Luminaries," in *From 4QMMT to Resurrection: Mélanges qumraniens en homage à Émile Puech* (STDJ 61; ed. F. García Martínez et al.; Leiden: Brill, 2006), 333–55.

[20] L. Hartman, *Asking for a Meaning: A Study of 1 Enoch 1–5* (Coniectanea Biblica, NT Series 12; Lund: Gleerup, 1979); G.W.E. Nickelsburg, *1 Enoch 1* (Hermeneia; Minneapolis: Fortress Press, 2001), 38–39, 152–55; D. Jackson, *Enochic Judaism: Three Defining Paradigm Exemplars* (LSTS 49; London: Continuum, 2004), 139–202.

[21] E.J.C. Tigchelaar, *To Increase Learning for the Understanding Ones: Reading and Reconstructing the Fragmentary Early Jewish Sapiential Text 4QInstruction* (STDJ 44; Leiden: Brill, 2001), 175–93; B. Nitzan, "The Idea of Creation and its Implications in Qumran Literature," in *Creation in Jewish and Christian Tradition* (JSOTSup 319; ed. H. Graf Reventlow and Y. Hoffman; Sheffield: Academic Press, 2002), 240–64.

[22] Stone has suggested that the Geez in *Jub* 1:29 is corrupt and that the original text read, approximately, "from the first creation until the new creation": M.E. Stone, "Apocryphal Notes and Readings," *IOS* 1 (1971), 126 (this emendation is accepted in DJD XIII, 27). The new creation in *Jub* 5:12 is mentioned following the corruption of the land by the watchers, thus continuing the cosmological concerns of the Book of Watchers. The phrase יום הבריה appears as a future time marker in 11QT[a] XXIX 9–10 (ed. Qimron), a passage which enhances our understanding of *Jub* 1:29. See also G. Brin, "Regarding the Connection between the *Temple Scroll* and the *Book of Jubilees*," *JBL* 112 (1993): 108–9.

sun, and the light of the sun shall become sevenfold, like the light of the seven days" (Isa 30:26, NJPSV).[23]

The notion that the astronomy and calendars currently in use originated in an ideal primordial state corresponds to common Ancient Near Eastern wisdom, most notably that centred in Mesopotamia. *Enūma Eliš* (sometimes called the "Babylonian Creation Myth") V 1–46 recounts the creation of the luminaries and their mechanisms. Horowitz has demonstrated that this pericope constitutes a poetic exposition of the astronomical wisdom current in Babylon at the time of the composition of *Enūma Eliš*, especially that found in the so-called "Astrolabes."[24] Many ancient authors sought to anchor what they conceived to be authoritative astronomical teaching in religion, myth, and ritual. I believe that this strategy was also adopted at Qumran.

Another important Mesopotamian source whose teaching is linked to Creation is the divinatory collection *Enūma Anu Enlil*, in which several literary passages are integrated into the various omen lists.[25] For our present purposes, it is illuminating to observe the prologue at the beginning of EAE 1, which describes the establishment of the world order:[26]

[23] See also J.C. VanderKam, "Scripture in the Astronomical Book of Enoch," in *Things Revealed: Studies in Early Jewish and Christian Literature in Honor of Michael E. Stone* (ed. E. Chazon et al.; JSJSup 89; Leiden: Brill, 2004), 89–103.

[24] Horowitz, *Mesopotamian Cosmic Geography*, 114–17, 144–48. See also H.L.J. Vantisphout, "*Enūma Eliš:* Tablet V Lines 15–22," *JCS* 33 (1981): 196–98.

[25] The two otherwise unrelated documents EAE and 4Q320 are thus brought into proximity by the manner in which literary passages are interspersed amongst the technical data they contain.

[26] The version cited here is the Akkadian, following L. Verderame, *Le tavole I – VI delle serie astrologica Enūma Anu Enlil* (NISABA 2; Messina: Di.Sc.A.M., 2003), 9. The translation follows D. Brown, *Mesopotamian Planetary Astronomy-Astrology* (Groningen: Styx, 2000), 255. A similar literary statement also appears at the end of EAE Tablet 22; cf. Horowitz, *Mesopotamian Cosmic Geography*, 146–47 for another possible such passage. Brown suggests that Tablets 1–22 once constituted a separate lunar text, framed by literary programmatic passages. According to Parpola, the prologue ascribes a religious meaning to the omen tablets: S. Parpola, "Mesopotamian Astrology and Astronomy as Domains of the Mesopotamian 'Wisdom'," in *Die Rolle der Astronomie in den Kulturen Mesopotamiens: Beiträge zum 3. Grazer morgenländischen Symposion* (ed. H.D. Galter; Graz: GrazKult, 1993), 55. Cf. further U. Koch-Westenholz, *Mesopotamian Astrology: An Introduction to Babylonian and Assyrian Celestial Divination* (Copenhagen: The Carsten Niebuhr Institute, 1995), 47–48, 77–78; B. Landsberger and J.V. Kinnier Wilson, "The Fifth Tablet of *Enūma Enuma Eliš*," *JNES* 20–21 (1961/1962), 172.

… e-nu-ma [d]A-num [d]En-líl [d]É-a DINGIR.MEŠ GAL.MEŠ ina mil-ki-šú-nu ki-i-nu GIŠ.HUR.MEŠ AN-e u KI-tim iš-ku-nu ana ŠU DINGIR.MEŠ GAL.MEŠ ú-kin-nu u_4-mu ba-na-a ITI ud-du-šu ša ta-mar-ti a-me-lut-tum [d]UTU i-na ŠÀ KÁ È-šú i-mu-ru qé-reb AN-e u KI-tim ki-niš uš-ta-pu-ú

When Anu, Ellil, and Ea, the great gods, in their sure counsel had fixed the designs of heaven and earth, they assigned to the hands of the great gods (the duty) to form the day well (and) to renew the month for mankind to behold. They saw the Sun God within the gate whence he departs (and) in between heaven and earth they took counsel faithfully.

The *Enūma Anu Enlil* series is based on the regularity of the motion of the luminaries, together with occasional exceptions interpreted as omens. The institution of this regularity is depicted at the beginning of the series. The prologue is followed by paragraph 1a, which speaks of the lunar omens. Since this paragraph does not relate to day 1 of the moon's orbit, however—as would normally have been expected—but rather to omens for the twenty-seventh day of the lunation, the prologue and the omina should not be read as a continuous narrative. A similar relation appears to obtain in 4Q319 and 4Q320, where the literary passages locate the technical lists within a theological and chronological framework, linking them to the fourth day of Gamul at Creation. As in EAE, the literary passages should not be regarded as constituting narrative continuity with the body of the list (see in detail below 5.3.5).

5.1.2 *4Q321 and 4Q321a*

4Q321 is dated paleographically to c. 50–25 B.C.E.[27] It is the most elegant and well-executed calendrical scroll from Qumran. In contrast to 4Q320, the author of 4Q321 had sufficient quality parchment material at his disposal. 4Q321 uses a system of full orthography, in words like בוא or the name מלאכיה, and is better preserved than 4Q320. Remains of seven written columns are extant, and at least three more columns of text must be assumed to exist, one at the beginning of the scroll and two in the middle.[28]

[27] DJD XXI, 68.

[28] In DJD XXI, only the extant columns are presented, the reconstructed columns 0I, 0IV, and 0VII being omitted. The reconstructed text of these columns can be found in S. Talmon and I. Knohl, "A Calendrical Scroll from Qumran Cave IV—Miš B[a],"

4Q321 contains two lists, both based on *mišmarot* dates:

Columns 0I–IV 8 List of lunar phenomena: X and *dwq*

Columns IV 8–VII Festival calendar

The second list resembles that of 4Q320 4 iii–vi, differing from the latter in its record also of the beginnings of months, unnoted in this part of 4Q320. A similar—although considerably more fragmentary—list is preserved in 4Q319 frgs. 12, 13, and 77.

4Q321a is dated somewhat earlier than 4Q321 (50–100 B.C.E.). Due to its fragmentary state, however, conclusions regarding its script and other scribal practices cannot be drawn. This scroll gives records for X and *dwq* which parallel those of the first list in 4Q321. Although Milik named the two scrolls Miš B^a and B^b, regarding them as two copies of the same composition, this designation must be considered erroneous. Not only do the two texts employ different numerical notations—4Q321 uses digits while 4Q321a signifies the numbers by words—but, more importantly, no proof exists that 4Q321a in fact contained the festival calendar.

Since the lunar information in 4Q321a is very meagre, we shall devote the present discussion to the larger scroll, 4Q321.

5.2 The Lunation in 4Q320 and 4Q321 and the Identity of X and *dwq*

5.2.1 *General*

Both 4Q320 and 4Q321 function according to a sexennial cycle. Based on a term in office of one week per course, the cycle in its entirety covered 312 weeks, allowing 13 weeks of service for each priestly course. This period equals six years of 364 days each:

24 x 13 = 312 x 7 = 2184 days = 312 weeks = 6 x 364 years

Tarbiz 60 (1991): 505–21 (Hebrew); V. Gillet-Didier, "Calendrier lunaire, calendrier solaire et gardes sacerdotales: recherches sur 4Q321," *RQ* 20 (2001/2002): 171–205. It is impossible to ascertain whether the scroll originally contained additional columns to those mentioned here.

Since the year begins on Wednesday, it does not contain a full number of weeks but is composed of fifty-one full weeks + two half-weeks at the beginning and end of the year. The *mišmar* of Gamul, for example, which serves only half a week at the beginning of the sexennial cycle, receives another half-week at the end of the cycle, at which time only does the count of thirteen weeks become even.

Although the sexennial cycle was designed for the *mišmarot* courses, it also bears astronomical significance. Comprising two precisely-matching triennial cycles, the lunar parametres for each given date are identical with those of the same date three years later. The matching dates thus differ only in the names of the serving *mišmarot*. As an example, we may adduce the lunar data for month IX in years 3 and 6 of the sexennial *mišmarot* cycle (4Q321 III 5, IV 4–5).

בْאْרבעהֹ בחזיר בארבעה בתשיעי ודוקה שבת י[חזקאל באחד ועשרים בוא

באר]בעה במלאכיה בארבעה בתשיעי ודוקה שבת באביה באֹחד [ועשרים בוא

> (The lunar phenomenon X occurs) in the fourth (day of *mišmar*) Ḥezir, (which is) in the fourth (day) of the ninth (schematic month); and its *dwq* (occurs in the) Sabbath of Ye[ḥezqel, (which is) in the twenty-first day in it (= the ninth month).
>
> [(The lunar phenomenon X occurs) in the fo]urth (day of *mišmar*) Malkiah, (which is) in the fourth (day) of the ninth (schematic month); and its *dwq* (occurs in the) Sabbath of Abiah, (which is) in the [twenty-]first day [in it (= the ninth month).

Having noted these facts, we shall leave aside the *mišmarot* data, which are not relevant for the interpretation of lunar theory in the scrolls. While 4Q321 and 4Q321a contain lunar data for the entire sexennial cycle, the extant frags. 1–2 of 4Q320 only reach the end of year 3. It would nonetheless appear that the lunar list in 4Q320 also covered the rest of the cycle, now unfortunately broken off.

In similar fashion to the lunar texts of AB and 4Q317 discussed above, the *mišmarot* texts seek to synchronize the lunar phases with the 364DY. The two traditions differ in the fact that, in contrast to the daily roster of the former, only two dates are noted in the course of each lunation in the latter. Furthermore, the *mišmarot* lunar texts continue the thought of 4Q317 as described above by omitting any reference to the spatial location of the moon.

We shall now demonstrate the system used in each of the lunar texts with several examples, opening with the description of two consecutive months in 4Q321 I 3–5 (DJD XXI, 69):

בחמשה באמר בשלושה וע[ש]ר̊י̊ם בעׂשׂ[ירי ודוקה בששה בי]שׁ̊באב [בעשרה בו]א

ב[ש]שׁה ביחזקאל בשנים ועשרים בעשתי עשר החודש ו̊[דוקה שבת ב]פ̊תחה [בתשעה בוא]

> (The lunar phenomenon X occurs) in the fifth (day of *mišmar*) Immer, (which is) in the t[we]nty-third (day) of the ten[th (schematic month); and its *dwq* (occurs) in the sixth (day of *mišmar*) Y]ešebab, [(which is) in the tenth (day) in i]t (= the tenth month).
>
> (The lunar phenomenon X occurs) in the [si]xth (day of *mišmar*) Yeḥezqel, (which is) in the twenty-second (day) in the eleventh month; and [its *dwq* (occurs in the) Sabbath of] Petaḥiah(!), [(which is) in the ninth (day) in it (= the eleventh month).

The above-quoted lines record two lunar phenomena which occur in months X and XI of the first year in the triennial cycle. 4Q321 does not date these phenomena according to lunar months. Rather, each lunar phenomenon is marked according to two sets of dating systems:

1. Its place in the *mišmarot* cycle—"the fifth of Immer"
2. Its place in the 364DY—"in the twenty-third of the tenth"

The date according to *mišmarot* always appears first, probably due to the high esteem in which it was held by the author.

In the lines quoted above, the first date refers to the unnamed lunar phenomena, termed here X, while the second date pertains to the phenomenon called *dwq*.[29] X occurs on 23/X and subsequently on 22/XI. *Dwq* occurs on 10/X and subsequently on 9/XI. Since the lunar months (29 or 30 days) are shorter than the schematic months (30 or 31 days), the lunar phenomena recede one or two days per month from their equivalent schematic dates. The time intervals between the lunar phenomena remain fixed: 13 days from *dwq* to X and 16/17 days alternately from X to *dwq*, depending on the length of the lunar month (29 or 30 days):

X → *dwq* 16 days

dwq → X 13 days total days per month: 16 + 13 = 29 days

[29] This term is always qualified by the possessive suffix ה or ו (see below 5.2.2).

X → *dwq* 17 days

dwq → X 13 days total days per month: 17 + 13 = 30 days

Despite the fact that it occurs after *dwq* in the respective months, X is mentioned first in the lines quoted above. This peculiarity is discussed below (5.3.6).

The lunar list in 4Q320 records the sequence of X phenomena, as in the following sample lines (4Q320 2 4–10; DJD XXI, 48):

4 השנה השנית *vacat*

5 ב 2 במלכיה ל 29 ב 20 ברישון

6 ב 4 בישוע ל 30 ב 20 בשני

7 ב 5 בחופא ל 29 ב 19 [בשלישי]

8 שבת בפצצ ל 30 ב 18 בר̇[ביעי]

9 ב 1 ב̇ג̇מו̇ל̇[ ]ל̊[29 ב 17 בחמשי]

10 ב 3 בידעיה ל̇ 3[0 ב 17 בששי]

4 The second year *vacat*

5 In (day) 2 of (*mišmar*) Malkiah; for 29 (days); in (day) 20 in the first (month)

6 In (day) 4 of (*mišmar*) Yešuʿa; for 30 (days); in (day) 20 in the second (month)

7 In (day) 5 of (*mišmar*) Ḥuppah; for 29 (days); in (day) 19 [in the third (month)]

8 (In) Sabbath of (*mišmar*) Happiṣṣes; for 29 (days); in (day) 18 in the f[ourth (month)

9 In (day) 1 of (*mišmar*) Gamul; for[29 (days); in (day) 17 in the fifth (month)]

10 In (day) 3 of (*mišmar*) Yedaʿiah; for 3[0 (days); in (day) 17 in the sixth (month)]

The quoted passage covers months I–VI in year 2 of the triennial cycle. Each line comprises three short phrases, exemplified below in line 6 (month II, year 2):

Date of X within the week of office of the *mišmarot*: ב 4 בישוע

The number of days since the previous X phenomenon: ל 30

Date of X in the schematic year: ב 20 בשני

The date of X recorded here is identical to that registered in 4Q321 I 7, where it is also left unnamed. The middle phrase of each line in 4Q320 notes the number of days as 29/30—identical to the alternating length of the lunar months. This important piece of data is not given in the lunar text 4Q321 but only in 4Q320. In correlating the data from 4Q320 and 4Q321, a set of three lunar items is thus created: X, *dwq*, and the number of days in the preceding lunar month.

Each schematic month usually contains one X occurrence and one *dwq* occurrence. In certain cases, however, two such occurrences appear in one schematic month. This happens in months which are 31 days long: after 30 days (17 + 13) or 29 days (16 + 13) the same lunar phenomenon occurs again within the confines of the same schematic month. In such cases, the list indicates the special double occurrence of this phenomenon by the words השנית or דוקה שנית. We shall now discuss some occurrences of this special case.[30]

a. Second *dwq*

The second *dwq* takes place in month IX of year 2 in the triennial cycle. Within the sexennial cycle, it will be encountered in month IX of years 2 and 5. 4Q321 II 4–6 preserves a description of month IX/2:

[שבת בבלגא] בׄארבעה עׄשר בתשיעי וׄדוקהׄ [באחד בחופה באחד] בתשיעי
°[דוק]הׄ שנית בשלושה בׄ[חזיר בשלושים] ואחד בׄ[וא

> [(X occurs on) the Sabbath of Bilgah (which is)] in (day) fourteen in the ninth (month); and its *dwq* (occurs) [in (day) one of Ḥuppah, (which is) in (day) one] in the ninth (month); and its [*dwq*] (occurs) for the second time in (day) three in [Ḥezir, (which is) in (day) thirty-]one in [it (= the ninth month).

A description of month IX in year 5 depends on the reconstruction of 4Q321a V 3–4. In addition to the fact that the word order differs slightly here from that of 4Q321, the state of preservation also makes further conclusions necessarily tentative:

שבת בׄ[חרים] בארבעה עׄ[שר בתשיעי ודוקו[31] באחד ביוירי]ב באחד בוא בשלושה
במלכיה בשׁׄ[לושים ואחד בוא דוקו שנית]

[30] Talmon and Knohl noted the phenomena of the "second X/*dwq*" in "A Calendrical Scroll from Qumran Cave IV," 515; see also DJD XXI, 67. For greater detail, see Gillet-Didier, "Calendrier lunaire, calendrier solaire."

[31] On the spelling דוקו in 4Q321a, see below 5.2.2.

(X occurs in) Sabbath in [Ḥarim], (which is) in (day) fourte[en in the ninth (month); and its *dwq* (occurs) in (day) one in Yehoyari]b, (which is) in (day) one in it (= the ninth month); in (day) three in Malkiah, (which is) in (day) th[irty-one in it (= the ninth month) falls its *dwq* for the second time.]

b. Second X

This event takes place at the very beginning of the triennial cycle, in month I of years 1 and 4 in the *mišmarot* cycle. The opening lines of 4Q320 attest to two consecutive X phenomena:

3 ... ב 4 בשבת

4 [ג]מ֯ו֯ל לחודש הרישון בשנה

5 [הרישו]נ֯ה֯ *vacat*

6 [ב 5 בידע]י֯ה֯ ל 29 ב֗ 30 בו

3 … (X occurs) in (day) 4 of the week

4 [G]amul, for the first month in year

5 the [fir]st (i.e., the first year) *vacat*

6 [in (day) 5 in Yedaʿ]iah; for 29 (days); in (day) 30 in it (= the first month)

The first X is recorded in lines 3b–5 not by numerical figures—as in the rest of the scroll—but in words, following the style of the literary prologue. Although the record for this day is separated from the rest of the list by a *vacat*, the information should be read sequentially as an account of two X occurrences within the first schematic month: on day 1 as well as twenty-nine days later (day 30).[32] Owing to the unique mode in which the first X was recorded in the prologue, the formula השנית is not required in this specific case. Nor can it be known whether X was recorded in 4Q320 at the beginning of year 4, since this part of the list is not extant. It may have appeared in the record of month I of year 4 in 4Q321 III 7–8 (DJD XXI, 72):[33]

[32] For the relation of the prologue to the body of the list, see below 5.3.5.

[33] An even more fragmentary record of the second X is extant in 4Q321a I 2–3 (DJD XXI, 84).

... הרביעית בארבעה בשכנ]יה באחד בראשון השנית בחמשה בישבאב בשלושים בוא ודוקה בששה ביקים בשבעה עשר ב]ר̊אישו̇ן

> … the fourth (year). (X occurs) in (day) 4 in Šekan[iah, (which is) in (day) 1 in the first (month); the second (X occurs) (day) 5 in Yešebab, (which is) in (day) thirty in it (= the first month); and its *dwq* (occurs) in (day) six in Yaqim, (which is) in (day) 17 in] the first (month).

A notable change in the lunar cycle takes place immediately following the month of "second *dwq*"—namely, a reversal of the order of the two lunar phenomena within the schematic month. X is invariably recorded before *dwq* throughout 4Q321, even when this order is not always concordant with the true order of the phenomena. The data on the order of X and *dwq* are presented in TABLE 5.1:

From month	To month	Chronological order of events
II/1	VIII/2	*dwq* → X
X/2	XII/3	X → *dwq*
II/4	VIII/5	*dwq* → X
X/5	XII/6	X → *dwq*

TABLE 5.1: The order of X and dwq *within the schematic month*[34]

Following the initial month and throughout approximately the first half of the cycle, *dwq* precedes X within the schematic month. For example, in month III/1, *dwq* occurs on day 16 and X on day 29. As the cycle proceeds—and the gap between the 29/30-day-long lunar months and the 30/31-day-long schematic months accumulates—the lunar phenomena float back in the schematic month. Thus, in month VII/2, *dwq* occurs on day 2 and X on day 15. Soon afterwards, with the second *dwq* of month IX/2, the order changes, *dwq* moving into the latter part of the schematic month.

Throughout the second half of the triennial cycle, X precedes *dwq* within the schematic month. Thus, for example, *dwq* occurs on day 29 and X on day 13 in month X/2. During this period of time, the fixed order of the list—where X is recorded before *dwq*—is indeed justified. As a new cycle begins, with the second X at the beginning of year 4, the order is reversed again.

It is difficult to account for the author's preferences when recording X and *dwq*. Conclusive answers can only be reached once the

[34] In this TABLE—as elsewhere in the present volume—years are marked in Arabic and months in Roman numerals.

astronomical significance of both X and *dwq* has been positively identified, a task to which we now turn.

5.2.2 Dwq—*A Morphological and Etymological Analysis*

The word דוק never appears in the scrolls in absolute form but is always qualified by the possessive suffix ה or ו. It appears in the orthographic variations דוקה, דוקו, דוקוה. Whereas the form דוקה is the norm in 4Q321, the orthography in 4Q321a fluctuates between the forms דוקה (x 1), דוקו (x 2), and the conflated form דוקוה (x 1). The fact that these variations occur within the same scroll demonstrates that they constitute mere orthographic variants rather than a change in the suffix's reference or any other grammatical factor.

The masculine possessive suffix refers to the moon ירח—"its (= the moon's) *dwq*." The frequent use of ה to denote this pronoun is misleading, given that it usually denotes the feminine possessive suffix. The noun ירח is always masculine in Hebrew, however, and the Qumran writings never mention the feminine synonym לבנה. As in biblical Hebrew, Qumran Hebrew allows for the representation of the masculine morpheme *ô* not only by ו but also by ה, as in the form אהלה "his tent" (cf. Gen 12:8).[35] The synthetic form דוקוה in 4Q321a V 5 is highly significant in this respect, since it reveals that the different orthographic forms are due to different methods of representation of the masculine suffix.

Several examples of writing of *ô* with the cluster וה are found in the Qumran literature.[36] A significant example is the writing of the (itself enigmatic) word אוט in 4Q418 126 ii 12 (DJD XXXIV, 350). In this particular case, the word was written with the masculine possessive suffix in the form אוטה. A corrective hand marked a dot above the ה to denote its deletion and inserted ו in its place. The result could have easily been understood by a copyist as the synthetic form וה. The

[35] See P. Joüon, *A Grammar of Biblical Hebrew* (trans. and revised by T. Muraoka; Roma: Pontificio Instituto Biblico, 2000), §94h.

[36] See Talmon and Knohl, "A Calendrical Scroll from Qumran Cave IV," n. 34, acknowledging a communication from E. Qimron. See also the discussion by E.Y. Kutscher, *The Language and Linguistic Background of the Isaiah Scroll (1QIs[a])* (STDJ 6; Leiden: Brill, 1974), 183ff. (I owe this reference to Ohad Cohen, Jerusalem.) Kutscher discusses several examples in 1QIsa[aa] where *ô* is represented by וה.

variations of the possessive suffix attached to *dwq* are thus due to the peculiarities of Qumran orthography. While he expert (and somewhat later) scribe of 4Q321 consistently used the form דוקה, the less proficient scribe who copied 4Q321a was seemingly less confident with respect to the preferable orthography. Although the limited vocabulary of the calendrical scrolls does not allow us to ascertain the type of orthography used by these scribes, the fact that 4Q321 consistently employs the full spelling בוא demonstrates that the scribe who wrote this scroll adhered to the orthography distinctive of Qumran.[37]

Further evidence that the possessive suffix refers to the moon comes from Babylonian texts on lunar visibility, where the lunar phases are often designated "ŠÚ / KUR / NA *ša* ^{d}*Sin*. The ŠÚ / KUR / NA of the moon."[38] In another case, we find the suffixed form NA-su, which resembles the Hebrew form *dwqh* even more closely.[39]

How much weight should be given to the etymology of the Hebrew term in deciphering its meaning is an issue of debate, since the meaning in the etymon may frequently undergo significant semantic transformations before it reaches the target word. When the usage is unclear and the word has no parallels in the target language, however, the search for etymology may prove useful. The review of the etymological data below primarily follows Wise's discussion.[40]

Hebrew lexicography does not know of *dwq* (and its derivatives) as a technical term in the astronomical and calendrical fields. In the Qumran corpus, the word appears once outside the *mišmarot*, in a locus description in the *Copper Scroll* (3Q15 VII 11–12):

[37] On the Qumran scribal school, see recently E. Tov, "Further Evidence for the Existence of a Qumran Scribal School," in *The Dead Sea Scrolls Fifty Years After Their Discovery: Proceedings of the Jerusalem Congress, July 20–25, 1997* (ed. L.H. Schiffman et al.; Jerusalem: Israel Exploration Society, 2000), 199–216, esp. 211–13; idem, *Scribal Practices and Approaches*, 261–73, 277–88.

[38] Mul.Apin II ii 43–44 and passim; cf. F. Rochberg, *Babylonian Horoscopes* (TAPS 88.1; Philadelphia: American Philosophical Society, 1998), 73.

[39] See ADRTB 1:21. Note that the suffix *–su* differs from the standard form *–šu*, indicating that the abbreviation NA stands for a word which ends with a sibilant, therefore requiring the change in the suffix. The identity of this word is not entirely clear, however. See below n. 96.

[40] Wise, *Thunder in Gemini*, 222–28.

בדוק תחת פינת המשמרה/ת המזרחית

In *dwk*, below the corner of the eastern guard post[41]

Although it is tempting to connect this note with the *mišmarot* scrolls since it contains both the words דוק and משמר/ת, these terms appear to carry a different meaning in the *Copper Scroll*. Lefkovits prefers the reading דוק over the other options suggested—דיק, etc.—concluding that the word refers to the desert fortress on Mount Qarantal just above Jericho, called Δωκ in *1 Macc* 16:15. This toponym derives from the Aramaic root *dwq* with the meaning "to watch," the noun signifying "watchtower" or the like. Lefkovits suggests an analogy with the place name צופים near Jerusalem. The Peshitta in fact renders the nouns צופים and מצפה as דוקא (Gen 31:49; Num 23:14; 2 Chr 20:24).[42] In the above-quoted sentence from the *Copper Scroll*, דוק "watchpost" and משמרה "guard post" are both closely associated with the military semantic field. In the *Copper Scroll*, דוק thus appears to constitute either a toponym or the term for an army post, linked to the location's nature as a lookout.

The Hebrew evidence providing only limited help, we now turn to the Aramaic. Although Jewish Aramaic—both Babylonian and Palestinian—knows the verbal use of *dwq* "look" in the *ʾaphʿel*, it never denotes an astronomical observation.[43] Nor does it use the noun דוקא in such a fashion. An example from Qumran Aramaic attests to the verb אדיק, "to watch, see" (*1 En* 9:1; 4QEn[a] 1 iv 6). In the Peshitta, the root *dwq* translates the Hebrew שקף (Gen 26:8) and נבט (Lam 4:16), both Hebrew roots signifying a form of observation/sight. Later Syriac sources attest to both verbal and nominal forms of the root *dwq* as connoting an astronomical observation.[44] Although the Syriac evidence is not particularly close to Qumran Hebrew, at least one further case can be adduced in which a scientific term is, somewhat

[41] The reading and translation follow J.K. Lefkovits, *The Copper Scroll 3Q15: A Reevaluation. A New Reading, Translation, and Commentary* (STDJ 25; Leiden: Brill, 2000), 232–34.

[42] The Aramaic Targum consistently employs the roots סכי and סכל in these verses. Cf. also the Peshitta to 2 Kgs 9:17 and Isa 21:9 and the rendering of צפצפה in Ezek 17:5 and דיק in 2 Kgs 25:1 and Jer 52:4; cf. C. Brockelmann, *Lexicon Syriacum* (repr. Hildesheim: Olms, 1966), 146–47.

[43] This is supported in the dictionaries published by Michael Sokoloff. My thanks are due to Prof. Sokoloff for his clarifications, in a private conversation.

[44] Wise, *Thunder in Gemini*, 227, based on R. Payne-Smith, *Thesaurus Syriacum* (Oxford: Clarendon, 1879), 847–49.

surprisingly, attested in both languages: the word מלוש with the meaning of "star" and more generally "fate."[45]

Although most scholars trace the term *dwq* in the *mišmarot* texts to the root *dwq*, signifying an observation of some kind, this is too general a derivation. The term does not denote the specific type of observation which would normally be expected from the context of the *mišmarot* texts. In contrast, the Mesopotamian designations for phases of lunar visibility—some of which we have quoted above—always relate to explicit occasions such as rising, setting, night, etc. It is difficult to consider that the lunar phases at Qumran could have been designated by such general terms.

Talmon and Knohl have claimed that *dwq* should be derived from the Hebrew root *dqq* "thin," denoting the day on which the moon begins to wane.[46] Although this possibility raises problems on a morphological level, the *waw* being awkward in a geminate verb, similar orthographies can be cited in Qumran Hebrew.[47] Lexical evidence for the root *dqq* primarily refers to the grinding of such materials as dust and incense until they are pulverized. Nominal forms of the root are also used to signify fine objects, such as בהמה דקה "a fine, thin animal" (i.e., sheep) in contrast to בהמה גסה (cattle). A further example is הדקין שבכלי חרס (*m. Kel.* 2:2), "the smallest of earthenware vessels." The root *dqq* never refers to phases of the moon. *Contra* Talmon and Knohl, it has been claimed that had the term *dwq* denoted the waning of the moon, it would not have referred to the day on which the moon *begins* to wane: on that day the moon is not at all דק "thin."[48] Similar reasoning has led Gillet-Didier to accept the etymology suggested by Talmon-Knohl while rejecting their identification of the astronomical event it denotes. In her opinion, although *dwq* is derived from *dqq*, it relates to the new crescent at the beginning of the lunation.[49]

[45] See M. Kister, "Three Unknown Hebrew Words in Newly-Published Texts from Qumran," *Lešonénu* 63 (2000/2001), 35–36 (Hebrew).

[46] Talmon and Knohl, "A Calendrical Scroll from Qumran Cave IV," 519; see also DJD XXI, 68.

[47] Cf. E. Qimron, *The Hebrew of the Dead Sea Scrolls* (HSS 29; Atlanta: Scholars Press, 1986), 65.

[48] J.C. VanderKam, "Calendrical Texts and the Origins of the Dead Sea Scroll Community," in *Methods of Investigation of the Dead Sea Scrolls and the Khirbet Qumran Site* (ed. M.O. Wise et al.; ANYAS 722; NY: NYAS, 1994), 382–83.

[49] Gillet-Didier, "Calendrier lunaire, calendrier solaire," 179–84.

The Mesopotamian material discussed in Chapter 4 appears to support the etymology and interpretation suggested by Talmon and Knohl. Since the Mesopotamian science of the early first millennium B.C.E. is now acknowledged as the source behind the Jewish astronomical tradition, it is plausible to seek the origins of Hebrew technical terms in the realm of Mesopotamian astronomy. Table B of EAE 14 contains the rare Akkadian term *maššartu*, from *našāru*, "wane, diminish." The term appears in the context of a sequence of periods of lunar visibility within the schematic month, *maššartu* appearing on the day after the full moon in the middle of the month.[50] Since the day of full moon is also the day of maximum night-time lunar visibility, this technical term may refer either to the decrease in the amount of light in the moon or to the decrease in the period of lunar visibility.

Mesopotamian science attests to the use of *našāru* in the technical context of lunar observations.[51] This usage closely resembles the context of the Hebrew *dwq*. Although it is difficult to prove any Hebrew dependency on the Akkadian, the proximity of contexts strongly suggests an association. Familiar with early Mesopotamian astronomy and the tables in AB, the Hebrew scribe was no doubt aware of the decrease in the night-time lunar visibility after the full moon. The term *dwq* may thus be included with other terms originating in Syrian-Mesopotamian science and divination which found their way into Qumran Hebrew.[52]

5.2.3 *The* Mišmarot *Lunar Texts and Other Lunar Texts from Qumran*

4Q320, 4Q321, and 4Q321a are the sole Qumran texts which delineate one or two phases in the lunation. In contrast, the lunar texts discussed

[50] See the lexical discussion in F.N.H. Al-Rawi and A. George, "Enūma Anu Enlil XIV and Other Early Astronomical Tablets," *AfO* 38–39 (1991/1992), 63. For another example of Qumran Hebrew imposing a new meaning onto an imported Hebrew word, see M. Weinfeld, *The Organizational Pattern and the Penal Code of the Qumran Sect* (NTOA 2; Fribourg: Editions universitaires, 1986), 13. I am indebted to Dr. Cana Werman for this reference.

[51] See CAD N/II mng. 3c, p. 63a; CDA, 245.

[52] The other terms are מלוש (noted above) and מולד: see M. Morgenstern, "The Meaning of *beit moladim* in the Qumran Wisdom Texts," *JJS* 51 (2000): 141–44.

in Chapters 2 and 3 here—AB, 5Q503, 4Q317, and 4Q334—record the lunar data for each day of the month. The question raised at this juncture is whether the two phases mentioned in the *mišmarot* scrolls may be aligned with the system of the earlier rosters or whether the *mišmarot* texts represent an alternative reckoning system. In other words, can we identify distinct items from AB or 4Q503 with a *dwq* or X date from 4Q321? Such an attempt has been made by both Wise and Abegg, the two scholars reaching opposite conclusions.[53]

The difference between the various lunar texts—those recording the daily lunar visibility and those counting distinct phases in each lunation—is itself traceable back to Mesopotamian texts. Within EAE 14, Tables A and B belong to the former group, while Table D, together with section 1 of Mul.Apin, belong to the latter. Although several minor differences between the different Tables of EAE 14 have been pointed out above (4.1.5), no doubt exists that they belong to the same framework. Can the same be asserted regarding the lunar texts represented in the Qumran sources? The divergence here appears to be more substantial. The authors of the Qumran daily lunar rosters faced numerous difficulties in aligning the fourteen parts of lunar visibility system with the length of the schematic month. In contrast, the *mišmarot* lunar texts avoided this problem by aborting the daily count and focusing solely on two phases in every month.

Francis Schmidt has argued with regard to 4Q503 that:

> … le calendrier de 4Q503 … et les calendriers dits « Mishmarot », dans les deux interpretations actuellement en discussion … n'appartiennent pas au meme ensemble calendaire, et qu'ils témionage de deux conceptions et de deux pratiques différentes du calcul des temps et des fêtes.[54]

[53] M.O. Wise, "Second Thoughts on *dwq* and the Synchronistic Calendar," in *Pursuing the Text: Studies in Honour of Ben Zion Wacholder on the Occasion of his Seventieth Birthday* (ed. J.C. Reeves and J. Kampen; JSOTSup 184; Sheffield: Academic Press, 1994), 98–120; M.G. Abegg, "Does Anyone Really Know What Time It Is? A Reexamination of 4Q503 in Light of 4Q317," in *The Provo International Conference on the Dead Sea Scrolls* (STDJ 30; ed. D.W. Parry and E. Ulrich; Leiden: Brill, 1999), 396–406.

[54] "Le calendrier liturgique des *Prières quotidiennes* (4Q503). En Annexe: L'apport du *verso* (4Q512) à l'edition de 4Q503," in *Le Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère* (JSJSup 112; ed. C. Grappe and J.C. Ingelaere; Leiden: Brill, 2006), 70.

We have demonstrated above (3.5.1) that the author of 5Q503 was unfamiliar with the triennial cycle but operated within the framework of a single schematic year—to be precise, a single schematic month. That month, moreover, was not intended to function as the basis of interpolation for other months—as, for example, in EAE 14—but contained specific liturgical instructions inapplicable elsewhere. It would therefore seem inadvisable to collate the evidence of 4Q503 with that of other lunar texts.

The case of 4Q317 appears to be different, this scroll being unconstrained by the liturgical elements of 4Q503 and pertaining, furthermore, to the entire triennial cycle. Although 4Q317 is thus significantly closer to the *mišmarot* texts, a series of other substantial difficulties manifests itself on closer observation.

The author and astute readers of 4Q317 were challenged when aligning the fourteen parts of lunar light with the number of days in the schematic month, being compelled to insert interlinear corrections with the counting of another half-part of light: ארבע עשרה וחצי. These glosses were inserted throughout 4Q317 on the days of the new and full moon.[55] This difficulty also generated a series of interlinear corrections of the numbers in 4Q317, with virtually every figure in the original text subsequently being amended. This is evident, for example, at the end of the column in frgs. 1+1a ii, where all the dates between lines 22 to 33—the bottom line of the column—have been corrected.[56] The original scribe measured the revealed (גלה) light of the moon from one part to thirteen parts. He then skipped the fourteenth part and reached the day of the full moon in line 28, where an interlinear insertion counted $14^1/_2$ parts.[57] These emendations are themselves a consequence of the problems encountered in lines 7–10 of the same column, in which variant datings were offered for the day of the full moon.

[55] Whether these were inserted by the original scribe or by a corrector is unclear. Wise ("Second Thoughts on *dwq*," 50) opts for a corrector, but the handwriting of the insertions resembles that of the original text rather too closely to make this a plausible proposal. The issue is especially problematic, of course, in regard to such encrypted documents as 4Q317.

[56] A preliminary transcription appears in Wise, "Second Thoughts on *dwq*," 112–14. An improvement has been suggested by Abegg in *DSSR* 4, 58–60.

[57] Wise, "Second Thoughts on *dwq*," 118. Abegg has also acknowledged this description, although he offers a different explanation of the entire scroll: "Does Anyone Really Know What Time It Is?," 405 n. 23.

While both Wise and Abegg endeavoured to discern the intention of the scribes of 4Q317, their respective reconstructions involve an unreasonable number of assumed mistakes on the part of the latter. Although the problems noted here in 4Q317 may indeed be due to a circumstantial series of mistakes, they are better accounted for as part of a fundamental incongruity between the fourteen-part theory and the number of days in the month. In contrast, the problems encountered in 4Q503 and 4Q317 are entirely obviated in the *mišmarot* documents, where only one or two lunar phases are noted monthly. This disparity led Albani to the following conclusion:

> Es ist also offensichtlich, dass astrHen und die astronomisch relevanten Texte der Calendrical Documents im Hinblick auf die Lunaren Zyklen unterschiedliche Gestalten des 364-Tage-Kalenders vertreten.[58]

4Q503 and 4Q317 consequently cannot be used to identify the astronomical significance of the phenomena X and *dwq* in the *mišmarot* texts.

5.2.4 *Earlier Attempts to Identify X and* dwq

The absence of unequivocal linguistic evidence for the identification of *dwq* and the inadequacy of information from other lunar texts from Qumran suggests that the resolution of the enigma should be sought in the numerical data. The time intervals between subsequent lunar phenomena are as follows:

X → *dwq* 16/17 days alternately

Dwq → X 13 days

Total 29/30 days alternately

Since a symmetrical view of the schematic month would have preferred a division of the month into parts of 15/15 or 14/15—as in Mul.Apin and EAE 14—the question arises why the *mišmarot* texts divide the lunation asymmetrically by the two lunar phenomena X and *dwq*.

[58] M. Albani, "Zur Rekonstruktion eines verdrängten Konzepts: Der 364-Tage-Kalender in der gegenwärtigen Forschung," in *Studies in the Book of Jubilees* (TSAJ 65; ed. M. Albani et al.; Tübingen: Mohr Siebeck, 1997), 91.

The scholarly near-consensus for the identification of *dwq* is represented by VanderKam, Glessmer, Albani, and Abegg among others, who view *dwq* as the new moon and X as the full moon, with the month beginning at full moon.[59] Either fourteen or fifteen days pass from the full moon to the end of the lunation, with an additional two days required until the new moon is visible. This accounts for the interval of 16/17 days from X to *dwq*. The time interval from *dwq* (new moon) to the next X at full moon is thirteen days.

Proponents of this view highlight the connection made at the beginning of 4Q320 between the first X day and the creation of the luminaries. The literary prologue in 4Q320 1 i 1–5 indicates that the first day of the year—also dated as the fourth day of Gamul—was simultaneously the day on which the luminaries were created. VanderKam has argued that the story of Creation is better understood if the moon was taken to be full at the time of its creation. The perfection of the Creation depicted in Genesis 1 would preclude any conception of the moon as a barely-visible crescent. VanderKam appeals in this context to a well-known rabbinic story concerning the creation of the luminaries.[60] According to this text, the sun and the moon possessed equal dimensions at creation, God subsequently diminishing the size of the moon.

[59] Wacholder and Abegg, *A Preliminary Edition of the Unpublished Dead Sea Scrolls*, 1:60, 68; VanderKam, "Calendrical Texts and the Origins of the Dead Sea Scroll Community," 380–83; idem, *Calendars in the Dead Sea Scrolls: Measuring Time* (London: Routledge, 1998), 79; Glessmer, "Calendars in the Qumran Scrolls," 250–52; M.G. Abegg, "The Calendar at Qumran," in *Judaism in Late Antiquity. Part Five: The Judaism of Qumran: A Systematic Reading of the Dead Sea Scrolls* (HdO I.56; ed. A.J. Avery-Peck et al.; Leiden: Brill, 2001), 1:149; Gillet-Didier, "Calendrier lunaire, calendrier solaire"; M. Albani, "Die lunaren Zyklen im 364-Tage-Festkalender von 4QMischmerot/4QS[e]," *Mitteilungen und Beiträge: Forschungsstelle Judentum* 4 (1992): 3–47; F. García Martínez, "Calendarios en Qumran (II)," *EstBib* 54 (1996), 523–25, 533; C. Martone, "Some Observations on New *Mishmarot* Texts from Qumran," in *The Provo International Conference on the Dead Sea Scrolls* (STDJ 30; ed. D.W. Parry and E. Ulrich; Leiden: Brill, 1999), 443–49; s.v. דוק in *The Dictionary of Classical Hebrew* (ed. D.J.A. Clines; Sheffield: Academic Press, 1995), 2:42; K. Koch and U. Glessmer, "Neumonds-Neujahr oder Vollmonds-Neujahr? Zu spätisraelitischen Kalender-Theologien," in *Antikes Judentum und Frühes Christentum: Festschrift für Hartmut Stegemann zum 65. Geburtstag* (ed. B. Kollmann et al.; BZNW 97; Berlin: de Gruyter, 1999), 114–36.

[60] VanderKam, "Calendrical Texts and the Origins of the Dead Sea Scroll Community," 383. For the rabbinic story and its versions, see M.M. Kasher, *Torah Shelemah* (NY: Beit Torah Shelemah, 1949^2) to Gen 1:16, §§627, 637 (Hebrew). An English version of the story is available in M.M. Maher, *Targum Pseudo-Jonathan on Genesis* (The Aramaic Bible; Collegeville: Liturgical Press, 1992).

On this interpretation, the Qumran authors considered the full moon to appear at the beginning of the month, with all the cultic implications this signifies.[61] This perception flouts every custom known to us from the Semitic sphere, however, where the word חדש by definition stands for the renewal of the moon at the beginning of the lunation.[62] Furthermore, AB—which constitutes the foundation for all the subsequent Qumran calendars—does not attest to the full-moon beginning of the lunar month.[63] Nor do the lunar texts 4Q503 and 4Q317 reflect such a view. Proponents of the full-moon reckoning adduce additional support for their claim by appealing to medieval reports on the Maghariah sect, which conceived the month as beginning at full moon.[64] These documents support others which suggest that sectarian practices from the Second Temple period persisted into medieval heretical sects, a circumstance which may witness to a textual and religious continuity between the two literary settings.[65] The provenance of heretical Jewish sects in medieval times is a highly intricate issue, however. Given the presence of multiple sources of influence on each sect, it is difficult to determine whether

[61] VanderKam, "Calendrical Texts and the Origins of the Dead Sea Scroll Community," 381 and n. 42, citing the similar view proposed earlier by Milik.

[62] This contention has itself been questioned by those scholars who consider that a full-moon reckoning of the month already existed during the period of the monarchy: see N.H. Snaith, *The Jewish New Year Festival: Its Origins and Development* (London: SPCK, 1947), 85–103; Koch and Glessmer, "Neumonds-Neujahr oder Vollmonds-Neujahr?"; A. Caquot, "Remarques sur la 'Néoménie' dans l'ancient Israël," *Revue de l'histoire des religions* 158 (1960): 1–18. These attempts have not won wide scholarly support, however.

[63] We have already rejected Saulnier's suggestion that AB acknowledges a full-moon beginning of the lunation above (2.2.2.2).

[64] VanderKam, "Calendrical Texts and the Origins of the Dead Sea Scroll Community," 383; Koch and Glessmer, "Neumonds-Neujahr oder Vollmonds-Neujahr?," 119; J. Fossum, "The Magharians: A Pre-Christian Jewish Sect and its Significance for the Study of Gnosticism and Christianity," *Henoch* 9 (1987): 303–44, esp. 304–7; Y. Erder, "The Observance of the Commandments in the Diaspora on the Eve of the Redemption in the Doctrine of the Karaite Mourners of Sion," *Henoch* 19 (1997): 175–202, esp. 185; idem, *The Karaite Mourners of Zion and the Qumran Scrolls: On the History of an Alternative to Rabbinic Judaism* (Tel Aviv: Haqibutz haMeʾuhad, 2004), 168–70 (Hebrew).

[65] The preeminent scholar of Karaism, Haggai Ben-Shammai, has called for prudence in the comparison of Karaite material with Second Temple sources: see H. Ben-Shammai, "Some Methodological Notes Concerning the Relationship between the Karaites and Ancient Jewish Sects," *Cathedra* 42 (1987): 69–84 (Hebrew). See also Y. Erder's argument in response in the same volume, "When did the Karaites first Encounter Apocryphic Literature akin to the Dead Sea Scrolls?": 54–68 (Hebrew).

the Maghariah's ideas concerning the full moon originated specifically from Qumran. We shall demonstrate below in detail, moreover, that the *mišmarot* lunar texts do not consider X to occur at the beginning of the month at all; nor do they prescribe the performance of any of the normal rituals and prayers of ראש חודש on that day. Since X constitutes an exclusively astronomical phenomenon in the *mišmarot* scrolls, any attempt to link it to testimony concerning the celebration of a cultic feast 1000 years later seems questionable.

The most significant claim for the full-moon beginning of the month rests on the evidence from the literary prologue to 4Q320. Lines 2–3 of this passage, which precede the list of X dates, refer to ל̊[א]י̊ר̇ה... מערב עד בוקר "to s[h]ine … from evening until morning." This line can only be understood as an allusion to the full moon, which sends forth its light in the night sky "from evening until morning." If the prologue refers to the full moon and immediately links it to "(day) 4 in the week of Gamul, in the first month of the first year," the obvious conclusion is that the creation of the luminaries—also the first X date—took place on a day of a full moon.

Talmon and Knohl, well reflected in Talmon's argument in DJD XXI, have proposed a different interpretation of this passage. According to these two scholars, X constitutes the day of conjunction—i.e., the day of complete invisibility. From that day, 16/17 days pass until the occurrence of *dwq*, which represents the day *after* the full moon, on which the moon begins to wane. Thirteen days pass from the onset of the moon's waning (*dwq*) until its completion at X. This view has been adopted by a limited number of scholars, primarily Wise and subsequently Ben-Dov and Horowitz.[66]

The apparent reference to the full moon in line 3 of the prologue does indeed constitute a problem for Talmon. He resolves the difficulty by (rather dubiously) construing the line as a reference to the sun, believing that the prologue originally constituted part of a recounting of the Creation story which preceded the extant portion of 4Q320. Line 3 thus constitutes a paraphrase of the locution ויהי ערב ויהי בקר, recurrent in the narrative of Genesis 1.[67]

[66] Wise, "Second Thoughts on *dwq*"; J. Ben-Dov and W. Horowitz, "The Babylonian Lunar Three in Calendrical Scrolls from Qumran," *ZA* 95 (2005): 104–20; see in detail below.

[67] Talmon, in DJD XXI, 44–47.

Talmon's particular interpretation of the data derives from his conviction that the *yaḥad* sharply opposed any reliance on the moon in calendrical matters. He considers it impossible that two monthly lunar phenomena were regularly observed as part of the calendar reckoning. Together with Knohl, he therefore claims that both X and *dwq* belong to the waning part of the lunation, the *yaḥad* regarding it as part of the community's polemics against the diminishable moon—a greatly inferior object to the sun with its never-altering dimensions.[68] In light of the fact that the moon is always treated neutrally at Qumran—the only exception being the *Book of Jubilees*, which is not strictly a Qumran text and for which another explanation may be adduced—we are of the opinion that no such condemnation of the moon is supportable. Although we accept Talmon and Knohl's identification of X and *dwq*—further evidence for which will be adduced below—we cannot adopt their view of the ideological background for the role of these phenomena at Qumran.

In his attempt to disprove Talmon and Knohl's interpretation of *dwq*, VanderKam asserts that:

> It would be curious to refer to a time when the moon is almost full by use of a word that means "thinness"… It would be more in harmony with procedures for lunar systems to associate the careful observation with a time around the first appearance of the new crescent.[69]

Abegg has put forward a similar argument:

> [T]he position of *dwq*, sixteen or seventeen days from the beginning of the month[,] is suggestive of an observational feature such as the first sighting of the crescent rather than the first day of the waning full moon, a difficult phenomenon to determine.[70]

It is precisely these claims, however, that provide the basis for a counter-argument. Ancient astronomy did not perceive the determination of the night of full moon as being based on a simple assessment of its dimensions—an observation frequently made impossible by weather conditions. Moreover, a naked-eye assessment of the size and form of the moon is subjective and often misleading.

[68] Talmon and Knohl, "A Calendrical Scroll from Qumran Cave IV," 520–21; DJD XXI, 47, 79.

[69] VanderKam, "Calendrical Texts and the Origins of the Dead Sea Scroll Community," 382–83.

[70] Abegg, "The Calendar at Qumran," 149.

The ancient astronomers rather preferred to determine the appearance of the full moon by measuring "crossings"—i.e., the time intervals between the rising and setting of the sun and moon.[71] The principle underlying this type of measurements has been neatly summarised by Hunger:

> Since the syzygies cannot be observed directly (except in the case of eclipses), the Babylonians observed the time difference between the crossings of the horizon by sun and moon as close as possible to the syzygy in question.[72]

Thus, *pace* VanderKam and Abegg, precise observation takes place on the day *following* the full moon rather than on the day of the full moon itself.

We have demonstrated above that the term *maššartu* from EAE 14 Table B constitutes the best candidate for the etymological source of *dwq*. Despite the evident similarities between the *mišmarot* lunar texts and such a text as Mul.Apin section l, however, the lack of correspondence between them requires further study of the Mesopotamian texts. Several divergences exist. Firstly, the *mišmarot* lunar texts only record the *date* on which periods of lunar visibility begin to be measured—without actually gauging them. Secondly, the schematic month in 4Q321 is divided into parts of 16/17 and 13 days rather than the 14/15 and 15 days of the early Mesopotamian sources. Further Mesopotamian analogies must consequently be sought.

5.3 Lunar Visibility at Qumran and in Late Babylonian Sources

5.3.1 *Non-mathematical Astronomy of the Persian and Hellenistic Period*

Towards the end of the Neo-Assyrian period, a new paradigm was introduced into Mesopotamian astronomy according to which accurate observations became more significant than the traditional schemes of

[71] We have discussed this practice with regard to Mul.Apin section l and EAE 14 in Chapter 4.

[72] ADRTB 1:20.

the earlier material.[73] In Babylon, diary records of astronomical phenomena had been kept from the time of Nabu-naṣir in the mid-eighth century B.C.E.[74] Several centuries later, the Babylonian discipline reached its peak in the ACT-type mathematical astronomy.[75] Together with this mathematical astronomy, Babylonian scribes created a large corpus of non-mathematical astronomy during the Persian and Hellenistic period. This body of texts was based on the raw data contained in the diaries, now presented in a classified and processed form. It consists of various types of astronomical lists and simple predictions. The documents of this corpus were first surveyed by Sachs in 1948 and are currently being published by Hunger (based on Sachs' transliterations) in the *Astronomical Diaries and Related Texts from Babylonia* (ADRTB) series.[76] The scientific discipline contained in these texts persisted throughout the Hellenistic period and beyond it, up until the end of the cuneiform culture in the first centuries C.E.[77]

Sachs classified the non-mathematical astronomical texts as:

[73] David Brown's book *Mesopotamian Planetary Astronomy-Astrology* (Groningen: Styx, 2000) is dedicated to this paradigm shift. According to Brown, while the old paradigm was oriented towards producing divinatory pronouncements, the new one was intended to yield accurate predictions of astronomical phenomena.

[74] See H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (HdO I, 44; Leiden: Brill, 1999), 139–44. The earliest extant diary dates from c. 651 B.C.E., the second earliest from c. 567 B.C.E. Earlier Babylonian diaries were apparently quoted by Hipparchus and Ptolemy: see G.J. Toomer, "Hipparchus and Babylonian Astronomy," in *A Scientific Humanist: Studies in Memory of Abraham Sachs* (ed. E. Leichty et al.; Philadelphia: Samuel Noah Kramer Fund, 1988), 353–62.

[75] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 139–82.

[76] A. Sachs, "A Classification of the Babylonian Astronomical Tablets of the Seleucid Period," *JCS* 2 (1948): 271–90. The categories preliminary suggested by Sachs have been maintained in the updated survey by H. Hunger, "Non-mathematical Astronomical Texts and Their Relationships," in *Ancient Astronomy and Celestial Divination* (ed. N.M. Swerdlow; Cambridge, Mass./London: MIT Press, 1999), 77. For a survey intended for lay readers, see F. Rochberg, *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture* (Cambridge: Cambridge University Press, 2004), 98–133.

[77] The last dated cuneiform text is in fact an almanac from 75 C.E.: see A. Sachs, "The Latest Datable Cuneiform Texts," in *Kramer Anniversary Volume* (AOAT 25; ed. B.L. Eichler et al.; Neukirchen-Vluyn: Neukirchener, 1976), 379–98; M.J. Geller, "The Last Wedge," *ZA* 87 (1997), 93–95.

Diaries

"Normal Star" almanacs

Almanacs

Goal-year texts

Although Sachs also surveyed the texts called "Horoscopes," he was reluctant to classify these together with the astronomical texts.[78] Notwithstanding modern prejudice, these horoscopes may nevertheless be counted as non-mathematical astronomy for our present purposes.

The non-mathematical texts contain information on the sun and moon (rising and setting, Lunar Six, eclipses) and the planets (conjunctions and acronychal phenomena). Fixed stars—especially the ecliptical groups known as "Normal Stars"—were employed as coordinates for the positions of the planets. The diaries additionally contain regular records of the weather in Babylon and the prices of various commodities, together with other notable occasions occurring during the period. They are generally accepted as the source for the observations contained in other astronomical texts.[79] In the present discussion we shall focus on the lunar texts.

These consist primarily of records of the Lunar Six—i.e., the time intervals between crossings of the horizon by sun and moon when setting and rising. This method is preliminarily discernible—on a strictly schematic basis—in Mul.Apin and in astronomical reports of the NA period (see Chapter 4); in later texts it is based on observational and/or computed data. The Lunar Six contain the following items:[80]

[78] A. Sachs, "Babylonian Horoscopes," *JCS* 6 (1952): 49–75; newly edited in Rochberg, *Babylonian Horoscopes*.

[79] On the relationship between observation and computation, see Hunger, "Non-Mathematical Astronomical Texts." On computation methods, see L. Brack-Bernsen, "Goal-Year Tablets: Lunar Data and Predictions," in *Ancient Astronomy and Celestial Divination* (ed. N.M. Swerdlow; Cambridge, Mass./London: MIT Press, 1999), 149–77.

[80] Hunger, "Non-Mathematical Astronomical Texts," 78; cf. ADRTB 1:20.

1. NA[81] – The time from sunset to moonset on the evening when the moon is visible for the first time after conjunction.

2. ŠÚ – The time from moonset to sunrise when the moon sets for the last time before sunrise [*sic*] (just before full moon).

3. NA – The time from sunrise to moonset when the moon sets for the first time after sunrise (just after full moon).

4. ME – The time from moonrise to sunset when the moon rises for the last time before sunset (just before full moon).

5. GE$_6$ – The time from sunset to moonrise when the moon rises for the first time after sunset (just after full moon).

6. KUR – The date and time from moonrise to sunrise when the moon is visible for the last time before conjunction.

Of the six items, number 1 is pertinent to the beginning of the lunation, numbers 2–5 (the Lunar Four)[82] pertain to the days immediately before and after the full moon, and number 6 belongs to the end of the lunation. The Lunar Six in these texts is usually accompanied by information on the length of the previous lunar month—whether 29 or 30 days. This calculation is conveyed by indicating the number 30 (if the previous month was hollow) or the number 1 (if it was full).

Together with information on the length of the month, the Lunar Six supplied the diviner and/or astronomer with the data required for the predictions of eclipses, the length of months, etc., together with horoscopes and omens.[83] Lunar Sixes were recorded either in distinct documents devoted to this purpose or within broader astronomical

[81] The list includes two items designated NA: one at the beginning of the month and the other in its middle. The present discussion will focus on the latter item (number 3 in the list).

[82] The group of four was defined and named by L. Brack-Bernsen, "Predictions of Lunar Phenomena in Babylonian Astronomy," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 5–19.

[83] A good example of the use of Lunar Six data in order to produce predictions can be found in the Uruk text TU 11: see L. Brack-Bernsen and H. Hunger, "TU 11: A Collection of Rules for the Prediction of Lunar Phases and of Month Lengths," *SCIAMVS* 3 (2002): 3–90. Another example is the atypical text K (BM 36722+): see O. Neugebauer and A. Sachs, "Some Atypical Cuneiform Texts, II," *JCS* 22 (1968/1969): 92–113.

texts. Some texts cite only part of the Lunar Six, with a great variety in selection being evident. ADRTB V §37 only records the number of days in the month and the NA of the beginning of the lunation. ADRTB V §38 gives the number of days in the month + NA (beginning of the month) + NA (mid-month) + KUR. ADRTB V §56, which is dedicated to the risings of Venus, notes the number of days in the lunar month + NA (beginning of the month) as background to the planetary data. Planetary texts frequently give the number of days in the lunar month without including any other lunar data.

5.3.2 *The Lunar Three*

Pertinent to the present discussion is a set of three items employed quite frequently in non-mathematical astronomical texts: 1) the number of days in the previous lunar month; 2) NA (mid-month); and 3) KUR. Sachs described this set of data as follows:

> Every Almanac is divided into 12 or 13 paragraphs, each of which refers to a single Babylonian month. A paragraph begins with the name of the month followed by the number 30 or the number 1. The number 30 means that the previous month contained only 29 days, the number 1 that the preceding month was 30 days long. At the proper place, every paragraph also contains the date (around the middle of the month) of a lunar phenomenon called na. This means that on that day the moon set for the first time after sunrise … Each paragraph, finally, contains a date (towards the end of the month) for a phenomenon called KUR, which refers to the last visibility of the moon … These three lunar phenomena (1 or 30, na, and KUR) I call the Lunar Three.[84]

While some texts record the accurate measurement of NA and KUR, others only signify the date on which these phenomena occur. Rochberg has noted such use of the Lunar Three in the horoscopes, dated to 409–68 B.C.E.[85] We are compelled at this point to enquire into the earliest documented record of the Lunar Threes and Sixes. Astronomers were already familiar with this type of measurement in

[84] Sachs, "A Classification of the Babylonian Astronomical Tablets," §16.

[85] Rochberg, *Babylonian Horoscopes*, 39–40. More than half of the 32 extant horoscopes record the Lunar Three. One of them employs the old designation UD.NÁ.A (common in Neo-Assyrian reports and in such texts as Mul.Apin and the Diviner's Manual) instead of the name KUR, more commonly used in late Babylonian astronomical texts. The same archaic designation also appears in the planetary text CBS 11901 (see below).

the late seventh century—certainly in the sixth—as Peter Huber has recently demonstrated.[86] Early diaries and other non-mathematical texts, however, only recall parts of this set in an inconsistent manner.[87] Similarly, a horoscope from 409 B.C.E. notes the Lunar Three without naming the items.[88] In later texts, reference to the Lunar Three becomes increasingly more standardized.[89] Thus almanacs and Normal Star almanacs—the earliest of which date to c. 292 and 261 B.C.E.—consistently refer to the Lunar Three by their standard designations.[90]

In summary, distinct items of the Lunar Six were present already in EAE 14 and Mul.Apin, as well as being noted in early diaries and related texts. Standardized use of the Lunar Three according to conventional terminology only occurs in the late fifth century B.C.E., however.

We shall argue below that the Lunar Three constitutes the closest parallel to the Qumran triad of data in the *mišmarot* lunar texts. The evidence of one specific Babylonian tablet is particularly revealing.

5.3.3 *The Lunar Text BM 32327+*

This tablet was copied in LBAT, preliminarily published by Sachs in 1952, and subsequently edited by Hunger in 2001.[91] It is difficult to fit this text into the categories proposed by Sachs; Sachs himself describes it as a "Seleucid tablet of an unorthodox type." The tablet contains records for the years 62–93 of the Seleucid era (SE)—i.e., in

[86] P.J. Huber and J.P. Britton, "A Lunar Six Text from 591 B.C.," *WZKM* 97 (2007): 213–17. This article renders superfluous the dating efforts of Hunger and Pingree, *Astral Sciences in Mesopotamia*, 175.

[87] Cf. the attestations of NA and KUR in ADRTB V §§ 12, 57.

[88] Rochberg, *Babylonian Horoscopes*, §2. The earliest horoscope which attests to the full record of the Lunar Three is §6, dated c. 258 B.C.E.

[89] For example, VAT 4936 (ADRTB I §66 rev. 3), a copy of a diary. A fuller diary is preserved in VAT 4924 (ADRTB 1:60–65), which does not mention KUR, however.

[90] Hunger and Pingree, *Astral Sciences in Mesopotamia*, 161.

[91] BM 32327 + 32340 (= LBAT *1432b): see A. Sachs, "Sirius Dates in Babylonian Astronomical Texts of the Seleucid Period," *JCS* 6 (1952), 110–11; ADRTB V §39. I was informed of this text by Prof. Wayne Horowitz and am indebted to him for inviting me to study it further.

the second half of the third century B.C.E. This dating approximates the period in which early parts of AB were composed.

The main part of the tablet records Lunar Threes for consecutive months. Additional material on the dates of cardinal points and Sirius' risings are recorded in the margins.[92] The lunar data for the year 63 SE, for example, runs as follows:

(Year) 63

I	1	13	27
II	30	14	27
III	30	15	28
IV	30	16	28
V	1	15	27/28
VI	30	16	28
VII	1	15	28
VIII	1	14	27
IX	1	ina 14	27
X	1	13?	26?
XI	30	13	27
XII	1	13?	[x]

In his ADRTB edition, Hunger outlines the contents of the tablet:

> This text … contains the length of the months, the calendar date of *the day (after full moon)* when the moon set for the first time after sunrise, and the calendar date of the last visibility of the moon towards the end of the month … (italics added)

The content of the columns (left to right) is as follows:

Column I – Month name (given here in Roman numerals)

Column II – Number of days in the previous month, expressed by 30 or 1

Column III – The day on which NA is first measured

Column IV – The day on which KUR is last measured

NA and KUR are neither measured nor identified by name but merely dated. This type of document commonly leaves some—or all—of the lunar items unnamed. Thus in the diary for -567, for example, only

[92] For Sirius, see Sachs, "Sirius Dates."

one lunar phenomenon is named (NA, in line 11), while the last visibility is left unnamed (line 7).[93] This closely corresponds to the usage in the Qumran lunar texts.

In an ideal scheme such as represented in EAE 14, the full moon will always occur on day 14/15 and its last visibility on day 27/28. In contrast, in such an observational (directly or obliquely) text as the present one, the date of the full moon fluctuates between days 13–16. Such a gap may have been caused by problems in visibility or stem from occasional faulty calendrical stipulations or intercalations which created a gap between the civil calendar and the lunar orbit. The material relevant for our present purposes concerns the time intervals between consecutive occurrences of NA and KUR. The following TABLE summarizes the data from BM 32327+, which is sufficiently lengthy and well preserved to produce a considerable stretch of months. For the sake of comparison, we also bring the intervals between NA and KUR in the Lunar Six text BM 55554 (ADRTB V §49), which contains fewer data.[94]

BM 32327	
NA > KUR	KUR > NA
13	17
13	16
14	14?
15?	16
13	16
14	16
14	16
13	17
13	17
12	17
13	17
12	17
13	16
13	17

BM 55554	
NA > KUR	KUR > NA
13	16
13	16
14	
12	17
13	16
14	16
14	16
13	16
13	17
	16
14	16
13	17
12	

[93] ADRTB 1:48–51.

[94] The TABLE only includes data from places in the list where two consecutive months are preserved, skipping those where such evidence is unavailable. Important as it is, the Lunar Three text CBS 11901 is too short and fragmentary to yield any significant sequence of numbers. The data processed from this text includes:

NA → KUR 12 days (x 1), 13 days (x 1)

KUR → NA 18 days (x 1)

13	16?
13?	16?
14	16?
14	16
13	16
13	17
13	17
13	16
14	15
14	16
13	17
12	17
13	17
12	17
13	17
12	17
13	16
14	16
14	16
14	16
12	17

TABLE 5.2: The number of days between X and NA, NA and X in Lunar Three lists

Summing up the data in this TABLE, the intervals are generally consistent:

NA → KUR 13/14 days (occasionally also 12 or 15 days)

KUR → NA 16/17 days

The inconsistent intervals constitute the primary divergence between the Babylonian text and the Qumran lunar material, a disparity which also obtains between the former text and such older texts as Mul.Apin and EAE 14. While the older cuneiform writings and the Qumran material are based on ideal schemes which yield unchanging figures, BM 32327 depends on actual observations and on the variable stipulations of the civil calendar. This accounts for the fact that the numbers in the Qumran roster are fixed—in contrast to the fluctuating numbers of the later Babylonian text.

NA and KUR both belong to the second half of the lunation—from the middle of the month after full moon to the last visibility. The intervals between NA and KUR thus divide the month into 16/17 and 13/14 days according to a non-symmetrical distribution.

5.3.4 *The Lunar Three and the Qumran Lunar Data: Comparison and Implications*

While the Babylonian text expresses the number of days in the previous month as 30/1, 4Q320 employs the numbers 29/30 respectively:[95]

	Babylonian Method	Qumran Method
Previous month hollow	30	29
Previous month full	1	30

The best interpretation of X and *dwq* in the Qumran texts is related to the Babylonian pair NA and KUR. Both sets constitute lunar phenomena from the second part of the lunation. As in BM 32327, the Qumran texts synchronize the lunar orbits with the cardinal days—i.e., with the fundamental structural element in the Jewish 364DY. With regard to the length of the intervals between adjacent phenomena, the figures for NA-KUR correspond to the Qumran material more closely than the symmetric division 15/15 in Mul.Apin section 1. The correspondence can be reproduced as follows:

BM 32327	NA→ KUR	KUR → NA
	13 or 14 days (occ. 12 or 15)	16 or 17 days
4Q320–321	*dwq* → X	X → *dwq*
	13 days	16 or 17 days

[95] I am unable to state whether the reasons for the different presentation are merely conventional or more substantial. Brack-Bernsen, "Goal-Year Tablets," 7, points out one exception from the regular Mesopotamian method for recording the number of days in the previous month.

We can thereby identify the lunar phenomena thus:

> X (Qumran) = KUR (Babylon) = last morning visibility of the moon at the end of the lunation
>
> *dwq* (Qumran) = NA (Babylon) = first moonset after sunrise, on the day following the full moon

The above considerations support the identification of X and *dwq* proposed by Talmon and Knohl, replacing the authors' theological hypothesis by a scientific framework. We have already demonstrated (5.2.2) that the term *dwq* may parallel the Akkadian term *maššartu*, supporting the interpretation of the former as a phenomenon which occurs after the full moon.[96]

Although 4Q320–321 function in the framework of a 364-day year, they also record the length of lunations. This feature constitutes the essential purpose underlying the Qumran texts—the attempt to synchronize the lunar cycles with the 364DY in the highly schematic fashion characteristic of Qumran astronomy and calendars. The fact that the Qumran texts incorporate the gap of 10 days between the luni-solar year of c. 354 days and the 364DY explains why X and *dwq* wander along the schematic months rather than remaining around the same date.

Having established that the recording of lunar phenomena at Qumran lies along a continuum from the cognate Mesopotamian tradition, we shall now proceed to evaluate the place of X and *dwq* in the sectarian calendar. The comparative method serves as an invaluable tool for this task since it highlights insights which would have gone unnoticed had we solely had access to the Qumran texts. In the absence of the Lunar Three parallels, it could have been claimed that, "… die lunaren Zyklen nicht … mit dem Neulicht beginnen,

[96] While the possibility of adducing a lexical correspondence between *dwq* and NA would have been even more satisfying, the meaning of the logogram remains obscure (see ADRTB 1:21). It is not even clear whether it should be copied as a Sumerogram (NA) or as an abbreviation of an Akkadian term (*na*). Hunger rejects the possibility that *na* is an abbreviation of *nanmurtu* "rising," since such an interpretation does not account for the suffixed form NA-*su*. He suggests that *na* stands for *manzāzu*—as in Mul.Apin II ii 8. This term is too general to indicate a distinct lunar phase, however. For folk etymologies of NA, see A. Livingstone, *Mystical and Mythological Explanatory Works of Assyrian and Babylonian Scholars* (Oxford: Clarendon, 1986), 28–29.

sondern mit dem Vollmond."[97] Indeed, since X and *dwq* appear side by side with such religious institutions as the festivals and *mišmarot*, it might easily have been assumed that these lunar phenomena played a role in the determination of the cultic calendar, with special rituals being performed on such days. Intercultural comparison proves quite the opposite, however.

Since no evidence exists for the enactment of new lunar festivals in the Late Babylonian period, it would be impossible—even absurd—to argue that the lunar phenomena NA and KUR possessed any religious significance. The Babylonian texts discussed here simply record the Lunar Three as part of a broad array of astronomical data. This is precisely the role the lunar data play in the Qumran texts: they constitute the standard set of data required for the description of any given month.

Religious time at Qumran was determined exclusively on the basis of the sacred 364DY, as all the sectarian calendrical texts testify. Even the biblical festival called חדש or ראש חדש, which marks the beginning of the month by the performance of special rituals, was fixed invariably at Qumran at the beginning of the *schematic* month, without any relation to the moon (cf. 4Q320 3 ii – 4 i; 4Q321 IV–VII; 4Q325; 4Q329 2). The lunar phenomena in Babylonia and Qumran alike are dated according to the normative calendar. In Babylonia, they are dated according to the civil calendar, which is by no means a strictly lunar calendar; at Qumran they are dated according to the 364DY, with its months of 30–30–31 days. The order of appearance of the lunar phenomena within the month—whether in Babylon or at Qumran—is linked to mathematical or astronomical considerations and carries no religious implication whatsoever.

The proponents of the 364DY did *not* maintain a cultic lunar calendar alongside their calendar tradition. Indeed, they traced the lunar orbit (more schematically than by observation), synchronizing it with the sacred year. Although at times ritual acts were linked to distinct lunar phases—as reflected in 4Q503—this association was made strictly within the normative framework of the 364DY. We have no indication that the authors of these texts counted an actual lunar *month*. The tracking of lunar phenomena in the *mišmarot* scrolls was maintained as part of the training of the calendar experts at Qumran,

[97] Albani, "Zur Rekonstruktion eines verdrängtes Konzepts," 91.

which continued as a distant echo of the ancient Mesopotamian discipline. The Qumran “scientists” adopted this practice, utilizing the Lunar Three while at the same time adapting the set to fit their distinct calendrical needs.

5.3.5 *Further Answers to the “*dwq = *full moon” Hypothesis*

We shall now address the evidence adduced by the proponents of the opposing identification, which remains the majority opinion. The most pertinent passage is the prologue to 4Q320, quoted here once again:

1]◦]לׄהראותה מן המזרׄח

2]לׄ֯[א]֯רׄהׄ[ב]מׄחצׄית השמים ביסוד

3 [הבריא]הׄ מערב עׄד בוקר ב 4 בשבת

4 [ג]מׄ֯וׄל לחודש הרישון בשנה

5 [הרישו]נׄ֯הׄ֯ *vacat*

The list (in the narrow sense) of X dates begins in line 6 after the *vacat*. This cannot be counted as the beginning of the list, however, since the item in line 6—“in (day) 30 in it (= the first month)”—is only the second X date of the cycle, while the first X date of the cycle—on 1/I—is recorded before the *vacat*. Moreover, the pronoun בו in line 6 refers back to “The first month” of line 4. The list must therefore be taken to begin in the middle of line 3, with the date “in (day) 4 of the week of [G]amul, at the first month in [the fir]st year.” This date constitutes the first X date of the cycle. The argument in favour of identifying X with the full moon is based on the conjunction of line 3 with the material preceding it. According to this theory, the fact that the beginning of line 3 refers to the full moon in the phrase “from evening until morning” and that the literary prologue is inseparable from the list of X dates leads to the indisputable conclusion that X = full moon.[98] We shall now point to some flaws in this argument.

The literary, indeed quasi-poetic, material in lines 1–3 is not entirely preserved. While the clearest part in this text is the phrase מערב עד בוקר, it is difficult to see how this expression is connected to

[98] This argument is best represented by VanderKam, “Calendrical Texts and the Origins of the Dead Sea Scroll Community,” 381.

that in line 2 ב[מחצית השמים "[in] the midst of Heaven"—i.e., at the meridian. The moon does not remain in the meridian throughout the entire night but crosses the sky during the night of the full moon.[99] Furthermore, proponents of the above-noted argument must explain why, when recounting the creation of the luminaries, the Qumran author focused his account on the nocturnal hours, disregarding the daytime. Why would an account of Creation in general—and of the sun in particular—focus solely on night time?

The fragmentary and laconic nature of lines 1–3a precludes the use of this unit as unequivocal evidence.[100] It is difficult to infer whether column 1 i was preceded by another column or columns of text. If lines 1–3 were indeed preceded by additional literary text, the statement may well have been located in an entirely different context.

The thematic connection between the prologue and the list must also be reexamined. Special significance attaches to lines 1–3, which are also echoed in the calendrical text 4Q319. The literary prologue was not intended to form the beginning of this specific list but rather to introduce the entire compendium of texts collected in 4Q320. The description of the creation of the luminaries in lines 1–3a thus comprises a general statement rather than part of the subsequent list. We therefore propose the following view of the components given in the first lines of 4Q320:

A (lines 1–3a) General introduction to 4Q320 (possibly beginning in a preceding column)

B (lines 3b–5) The first item in the list of X dates, in literary form

C (lines 6ff) List of X dates, in list form

A measure of support for this structure of the prologue comes from the literary prologue of *Enūma Anu Enlil*, quoted above (5.1.1.1) in regard to the concept of Creation. Immediately following the description of Creation in the prologue, the text moves to the lunar omens contained in the first tablets of EAE. Rather than beginning with day 1 of the month, as would have been expected, it opens with the last visibility

[99] Albani endeavoured to resolve this difficulty by claiming that the phrase "in the midst of Heaven" should not be taken literally but represents a metaphor for power: Albani, "Die lunaren Zyklen," 24 and n. 57. I find this argument unconvincing.

[100] Thus also Wise, "Second Thoughts on *dwq*," 102 and nn. 14, 15.

on day 27. Thus, although the description of the distribution of offices between the great gods in the prologue supplies a theological framework for the entire series, it does not directly relate to the contents of tablet 1. While 4Q320 may or may not constitute a similar case, the argument which ties the prologue and the list together is not indisputable.

The separation of the prologue from the list also undermines VanderKam's second argument with respect to the rabbinic story concerning the creation of the moon as a fully-lit disc (see above 5.2.4). Although rabbinic aggadah may well have conceived that the moon was created full, this fact is not necessarily relevant for the interpretation of the following list. It is a rule in rabbinic lore that אין משיבין על הדרש, "one does not present objections to a *derash*." It is thus possible that the list—based on the notion that the moon was created as an empty disc—was augmented by an aggadic passage representative of an alternative view.[101]

5.3.6 *The Order of X and* dwq *in 4Q321*

One final—significant—obstacle faces the currently-proposed identification of X as the last visibility of the moon. This relates to what appears to be a preference for X in the *mišmarot* scrolls. X heads the text of 4Q320 and constitutes the only subject matter of the lunar list it contains. It also stands at the beginning of every monthly record in 4Q321 and 4Q321a, even when actually occurring after *dwq* within that month. We must therefore examine the possible meaning of this astronomical phenomenon.

The only study which has thus far addressed this question is an article by Gillet-Didier (henceforth GD).[102] Concurring with the majority opinion, GD identifies X with the full moon and *dwq* with the new moon, but sees *dwq* as a derivation from the root *dqq*. She

[101] A similar case occurs in the rabbinic calendrical material (discussed above 5.2.4). According to the *tequfah* of Rav Ada, the moon was dark at the time when the sun was created on the equinox point. Although this coincidence contradicts the aggadic account on the creation of the luminaries in some respects, rabbinic writers failed to note the discrepancy. Calendar and aggadah being so remote in literary genre, the aggadic implications of this calendrical detail were thus never addressed.

[102] Gillet-Didier, "Calendrier lunaire, calendrier solaire." We shall refer to this article below without noting the precise page numbers for each reference.

underscores the importance of "Second *dwq*" and "Second X" as key points in fixing the order of lunar phenomena in 4Q321. From the precedence of X she adduces that it was of primary importance in the eyes of the author, *dwq* being only of secondary significance. She thus claims that 4Q321 reflects a lunar calendar whose months began with the full moon rather than with the new moon. According to GD, this novel concept constituted a rebellion against the commencement of the month at the new moon, a notion accepted not only in the mainstream luni-solar calendar but also in the Enochic Astronomical Book. The Qumran sectaries gave precedence to the full moon as an act of opposition against mainstream Jewish practice. At the same time, they designated the new moon by the condescending epithet *dwq* in order to avoid the more common positive term *ḥdš*. Although four different festivals occur on X dates within the festival calendar at the end of 4Q321, not one festival occurs on a day of *dwq*.[103] In GD's eyes, this constitutes further evidence that X—i.e., the full moon—possessed a positive religious value in the author's eyes.

Some of the points in this argument are admittedly difficult. The calendrical texts remain conspicuously silent regarding the assignment of any religious value—positive or negative—either to the moon in general or to a lunar phase in particular. Nor is any objection to earlier methods or calendrical reform mentioned. On the contrary, there is much to commend continuity—within a reasonable degree of development—from AB to the *mišmarot* texts, rather than a full-scale paradigm-shift. Furthermore, since GD links the "full moon reform" with the anti-lunar statements of *Jubilees* and similar statements (p. 184), one wonders what reason would prompt the anti-lunar reformer to think so highly of the full moon. It would make more sense to conceive of the full moon as a prominent lunar symbol: an anti-lunar reformer would be more likely to endorse a solar calendar or a schematic one—as in *Jubilees.*

If not for theological reasons, why *does* X precede *dwq* in 4Q321 and constitute the single focus of the lunar list in 4Q320? We suggest that the answer to both these questions lies in a scientifically-based preference for characterizing the lunar months using phenomena related to the end of the lunation. The data on the length of the

[103] The festival which occurs on X dates is the festival of Sukkoth in years 2 and 5. GD also counts the beginning of the year (1/I) in years 1 and 4 of the cycle. This festival is not mentioned in the lists of 4Q320 and 4Q321, however.

previous month, plus the data on last visibility, are sufficient for predicting the length of the next lunar month. Thus, the "Diviner's Manual" (lines 58–61) records "the day of the disappearance of the moon" (*biblu*) as the first astronomical phenomenon to be thoroughly observed.[104] Two methods for the producing of such predictions are contained in the late Babylonian text TU 11 (late third century B.C.E.) §§ 19, 22, as Brack-Bernsen has demonstrated.[105] While it is naturally impossible to claim that the *mišmarot* texts relied on the methods of TU 11, Brack-Bernsen has shown that this text contains numerous earlier methods current in the circles of Babylonian astronomers.[106] TU 11 therefore constitutes a collection of calendrical-astronomical principles, some of which may have reached the Jewish astronomers together with other astronomical material. The preference for observations of the last visibility in 4Q320 and 4Q321 thus reflects scientific interests rather than religious principles. The antecedents for these scientific interests are demonstrably present in traditional Babylonian astronomy.

5.4 CONCLUSION

The record of lunar phenomena in the *mišmarot* scrolls reflects the methods current in non-mathematical Babylonian astronomy, modified in Qumran in order to correspond to the sectarian calendar. After demonstrating the inadequacy of Mul.Apin and EAE 14 for accounting for the lunar *mišmarot* texts, we discovered closer parallels in later Babylonian astronomy. These confirm that X should be identified with the last lunar visibility and *dwq* with the day following the full moon. X and *dwq* were not conceived as religious festivals but rather as helpful astronomical data. The use of the Lunar Three in the *mišmarot* texts constitutes a significant development from the methods employed in AB and related texts since it averted the problematic count of fourteen "parts" of lunar visibility. The *mišmarot* scrolls

[104] Cf. C. Williams, "Signs from the Sky, Signs from the Earth: The Diviner's Manual Revisited," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 475–76.

[105] Brack-Bernsen, "Goal-Year Tablets," 11–14. Cf. also the method of the atypical text K in Neugebauer and Sachs, "Some Atypical Cuneiform Texts, II," 96–101.

[106] Brack-Bernsen, "Goal-Year Tablets," 15. On pp. 12–13, she adduces parallels to the methods of TU 11 in earlier cuneiform texts.

imply that special significance was assigned to observations of the last lunar visibility.

While the majority opinion—identifying X with the full moon—was primarily based on the implications of the prologue to 4Q320, a methodologically sounder practice would appear to demand a separation of the exegesis of the literary prologue from that of the following roster.

CHAPTER SIX

BETWEEN BABYLONIA AND JERUSALEM: THE NATURE AND DATE OF THE CONTACT

6.1 Nature and Date of the Cultural Contact

During the course of the Second Temple period, generations of Jewish authors in created a stable yet dynamic scholarly tradition based on the 364DY and its trajectories. These authors produced a series of calendrical writings around a scientific infrastructure borrowed from Mesopotamian sources and adapted to their specific religious and apocalyptic interests. This imported knowledge played a part not only in the discipline's early phases but also in its later stages—i.e., in the lunar texts from Qumran.

The Mesopotamian teaching integrated into the Jewish 364DCT did not derive from the civil Mesopotamian calendar but from a more esoteric, ideal calendar whose origin lay in the scientific-scholarly tradition. The fact that the civil Babylonian luni-solar calendar won great popularity in the Ancient Near East is reflected in its adoption by the Persian and Seleucid Empires. This calendar, for example, is the source of the names of the Jewish months, as well as of many other elements of non-sectarian Jewish time-reckoning.[1] In contrast, the evidence from Qumran attests to the existence of a scholarly tradition independent of the imperial administration. Since this scholarly discipline—initially based on the ideal 360-day year but gradually modulating into a 364-day year—was considered secret and esoteric in Babylonia itself, the Jewish scholars who borrowed it evidently had

[1] See E. Auerbach, "Die babylonische Datierung im Pentateuch und das Alter des Priester-Kodex," *VT* 2 (1952): 334–42; B.Z. Wacholder and D.B. Weisberg, "Visibility of the New Moon in Cuneiform and Rabbinic Sources," *HUCA* 42 (1971): 227–42; P. Davies, "Calendrical Change and Qumran Origins: An Assessment of VanderKam's Theory," *CBQ* 45 (1983): 80–89; G. Galil, "The Babylonian Calendar and the Chronology of the Last Kings of Judah," *Bib* 72 (1991): 367–78; D. Talshir and Z. Talshir, "The Double Month Naming in Late Biblical Books: A New Clue for Dating Esther?," *VT* 54 (2004): 549–55; L.-J. Bord, "L'adoption du calendrier babylonien au moment de l'exil," in *Le Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère* (ed. C. Grappe and J. C. Ingelaere; JSJSup 112; Leiden: Brill, 2006), 21–36.

access to the very heart of the scholarly institution. In Peter Kingsley's words:

> The transmission was not … a straightforward matter of contact between the periphery of one religion and the periphery of another. On the contrary, the transmission seems to have occurred directly between the heart of one tradition and the heart of another …[2]

While the fact that the Jewish sources acknowledge the number 364 alongside the ideal 360-day year is largely attributable to Jewish septenary trends, the practice also indicates that Babylonian knowledge reached Jewish hands during a period in which the number 364 was still actively employed in Babylonia. We have demonstrated above that this phase of Babylonian astronomy existed for a short period around 700 B.C.E., in close proximity to the final redaction of Mul.Apin.

Albani and Glessmer have shown how Mul.Apin and the type of astronomical reflection it contains constituted a central source of influence on Enochic astronomy. The primary focus of the Enochic authors lay on the system of the twelve heavenly gates and the elements deriving from it: the sun's position on the horizon, the length of daytime and night time, and periods of lunar visibility. This information is contained in the water-clock section and in the "intercalation schemes," the sections of Mul.Apin which most closely resemble AB.

In the present work we have paid particular attention to the traditional Babylonian models of lunar visibility. Constituting an elaboration of the water-clock formula, these models are contained in tablet 14 of *Enūma Anu Enlil* and section 1 of Mul.Apin. Drawnel's recent contribution has made it possible to demonstrate how the Aramaic models of lunar visibility contained in 4Q208 and 4Q209 adopted the traditional Babylonian system and modified it to fit their specific needs. As in Mul.Apin, the lunar data was merged together with other branches of astronomy and meteorology.

The material relevant to this cultural transfer came into use in Mesopotamia in the eighth–seventh centuries B.C.E., circulating up until the Hellenistic period and beyond, well after Babylonian scholars were already in possession of improved models. The transfer of

[2] P. Kingsley, "Ezekiel by the Grand Canal: Between Jewish and Babylonian Tradition," *JRAS* Series 3, 3 (1992), 345.

knowledge to Judaea could therefore have taken place anytime between c. 700 B.C.E. and the composition of the Aramaic AB. The latter is usually dated to the mid-third century B.C.E., although numerous scholars prefer a much earlier date, as far back as the Persian period.[3] In fact, the cultural contact may date as early as the Neo-Babylonian period. The Babylonian exile serves as a naturally conducive setting to cultural transfer, Babylonian knowledge being easily carried back to Jerusalem by the returnees at the time of the Restoration (fifth century B.C.E.). A later cultural contact cannot be excluded, however. Nor do we possess any substantive information regarding the mode of transmission: in which language it was communicated and through which circles. Having examined the material contained in AB, we shall now seek further answers to these questions in the Qumran material.

Some fragmentary literary passages in 4Q319 and 4Q320 resemble the literary prologues interspersed throughout EAE. In both texts, the literary passages help frame the technical material within the religious context of Creation narratives—a time when the world enjoyed a pristine, unpolluted natural order.

The lunar data contained in 4Q320, 4Q321, and 4Q321a attests to the use of the Lunar Three as a standard set for characterizing each month. Lunar visibility is expressed in these scrolls by a record of two monthly phases close to the syzygies. The *mišmarot* lunar texts thus stand apart from the earlier lunar texts associated with the teaching of AB, in which visibility was meticulously recorded day by day. Although the measuring of "crossings"—time periods of lunar visibility between the rising and setting of sun and moon—is already attested in Mul.Apin and EAE, we have demonstrated above that better parallels to the Qumran rosters can be found in Late Babylonian non-mathematical astronomy. One of the closest parallels to the

[3] This opinion is held by numerous scholars, including K. Koch, *Vor der Wende der Zeiten: Beiträge zur apokalyptischen Literatur: Gesammelte Aufsätze Band 3* (ed. U. Glessmer and M. Krause; Neukirchen-Vluyn: Neukirchener, 1996), 6 (fourth century and even earlier); G.W.E. Nickelsburg, *ABD* 2:509 ("in the Persian period"); S. Talmon, "Calendars and Mishmarot," *EDSS* 1:108–117; P.S. Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," in *The Wisdom Texts from Qumran and the Development of Sapiential Thought* (BETL 159; ed. C. Hempel, A. Lange, and H. Lichtenberger; Leuven: Peeters and Leuven University Press, 2002), 232 ("around 400 B.C.E.").

Qumran texts, BM 32327+, was composed in the mid-third century B.C.E.

The use of the Lunar Three at Qumran consequently appears to parallel its employment in Babylon during the late Persian and Hellenistic periods. Having established that the lunar procedures in the *mišmarot* texts from Qumran differ from the earlier Jewish lunar texts in AB, we would suggest that a second wave of Babylonian influence occurred following the composition of AB but prior to 4Q320, the latter dated to the late second century B.C.E.

The following table outlines some of the stages in the history of Mesopotamian astronomy pertinent to the present study of its transmission to Jewish circles.

Century	**Mesopotamian Astronomy**	**General**	**Judaea and Qumran**
7	Neo-Assyrian scholars use Mul.Apin and EAE Early predictive astronomy	Fall of the NA Empire	
6	Lunar Three and Six come into use	NB Empire Persian Empire	Babylonian exile
5	Invention of the Zodiac Unstable use of Lunar Three Early Horoscopes		Restoration
4	Standardization of Lunar Three	Macedonian conquest	
3	BM 32327+ Berossus		First Aramaic versions of AB
2	Hipparchus		Foundation of the *yaḥad*? 4Q320
1			4Q321 and 4Q321a

TABLE 6.1: Chronological table of events in non-mathematical astronomy

Transmission of the Lunar Three from Babylonia to Judaea may correspondingly be dated either before or after the Macedonian conquest. According to the first possibility, this knowledge was transmitted, together with Mul.Apin and EAE, by Jewish scholars in the Neo-Babylonian or Persian periods. It remained underground for several centuries until it surfaced at Qumran towards the end of the second century B.C.E. If, however, the Lunar Three was already known by Jews in Persian times, its conspicuous absence from earlier writings such as AB is difficult to account for. A more feasible explanation for its nonappearance is that the Lunar Three was not yet available to the Enochic authors.

According to the second dating scheme, knowledge of the Lunar Three only reached Judaea during the Hellenistic period. The possible existence of Jewish literati who received cultural knowledge from Babylonia, either directly or obliquely, during the Hellenistic period, possesses significant historical implications. Such a circumstance would indicate that the cultural contact between Babylon and Jerusalem was not a one-time cultural phenomenon but a long lasting one. The main difficulty facing this theory is the question of why the Lunar Three was modified in the Qumran scrolls rather than being retained in its conventional form.

Of the two possible dates, the first appears to pose more serious problems. Why is the Lunar Three—or any other method of designating certain "crossings" as a sample for the entire month—not represented in AB? The most plausible answer is that this knowledge reached the Jewish authors at a fairly late date, at which point they employed a variation of the Lunar Three set. Such variation existed already within the Babylonian discipline, and was further developed at Qumran. The mid-third century dating of the similar document BM 32327+ also supports a late date for the transmission of the Lunar Three to Judaea. In fact, this set of lunar data appears to have been used simultaneously in Babylonian and Judaea.

The transfer of knowledge from Mesopotamia to Judaea during the Second Temple period can consequently be identified as occurring in two—or possibly more—waves. An initial contact conveying Mul.Apin-type astronomy took place at an early period, many years prior to the foundation of the *yaḥad*. A second movement—which included the Lunar Three—occurred during the third–second centuries B.C.E. This period also constituted an era of intensive transfer of scientific knowledge from Mesopotamia to the Hellenistic world.[4] The

[4] See A. Jones, "Evidence for Babylonian Arithmetical Schemes in Greek Astronomy," in *Die Rolle der Astronomie in den Kulturen Mesopotamiens: Beiträge zum 3. Grazer morgenländischen Symposion* (ed. H.D. Galter; Graz: GrazKult, 1993), 88: "The general pattern of transmission of Babylonian astronomy seems to be a gradual trickle of basic concepts and the occasional parameter from about 500 B.C., followed by a sudden flood of detailed information in the second century B.C."

Babylonian material reached a restricted circle of scholars in Judaea, who made limited use of it in the calendrical texts they produced. Other texts from Qumran, including the apparently sectarian scrolls 4Q503 and 4Q317, adhered to the older methods employed in AB, improving on them slightly.

6.2 MESOPOTAMIAN ELEMENTS IN THE ENOCHIC AND QUMRAN LITERATURE

In order to ascertain the *Sitz im Leben* of the Mesopotamian knowledge in Second Temple Jewish circles, further examples of such knowledge must be adduced. A good example comes from the early Enochic traditions. The presence of Mesopotamian material in early Enochic traditions has been the subject of extensive discussion during the last century and earlier.[5] Although the key studies in this field remain those by VanderKam and Kvanvig from the 1980's, the literature on the subject continues to expand.[6] Although most of the parallel Mesopotamian and Enochic material was already known to scholars in the early twentieth century, the perception of the extent of the contact has widened as new texts have been revealed. The publication of new sources on Enmeduranki generated subsequent

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Hipparchus used and transmitted Babylonian observations and theories in the second century: see Neugebauer, *HAMA*, 339–43; G.J. Toomer, "Hipparchus and Babylonian Astronomy," in *A Scientific Humanist: Studies in Memory of Abraham Sachs* (ed. E. Leichty et al.; Philadelphia: Samuel Noah Kramer Fund, 1988), 353–62. About a century earlier, such a transfer was conducted by Berossus, Pingree claiming that Berossus was responsible for the transmission of the Babylonian System A: see D. Pingree, "Legacies in Astronomy and Celestial Omens," in *The Legacy of Mesopotamia* (ed. S. Dalley; Oxford: Clarendon, 1998), 134. Such traditions on Berossus are found in Vitruvius, *de Architectura*, 9 §§ 2.1, 6.2, 8.1. A full examination of Babylonian transmissions to the Greek world exceeds the scope of the present work.

[5] The scholarship up until 1980 has been summarised in J.C. VanderKam, *Enoch and the Growth of an Apocalyptic Tradition* (CBQMS 16; Washington, D.C.: Catholic Biblical Association, 1984), 11–20. For the Mesopotamian antecedents of the figure of Enoch in Gen 5:21–24, see U. Cassuto, *A Commentary on the Book of Genesis* (trans. I. Abrahams; Jerusalem: Magnes, 1964), 281–86; C. Westermann, *Genesis 1–11* (trans. J.J. Scullion; Minneapolis: Fortress, 1994), 348–52.

[6] VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*; H.S. Kvanvig, *Roots of Apocalyptic: The Mesopotamian Background of the Enoch Figure and of the Son of Man* (WMANT 61; Neukirchen-Vluyn: Neukirchener, 1988). See more recently, A.A. Orlov, *The Enoch-Metatron Tradition* (TSAJ 107; Tübingen: Mohr Siebeck, 2005), 23–39.

works by Kvanvig and VanderKam,[7] while Albani could only write his study of AB following the full publication of Mul.Apin in 1989. Later still, the publication of EAE 14 and of the non-mathematical astronomical texts provided the ground for the theories expounded in the present study.

The Mesopotamian motifs so far identified in Enochic literature include Enoch and the seventh antediluvian king; Enmeduranki, the primordial king, founder of the disciplines of divination and astrology; the seven legendary sages (*apkallū*), especially the first sage, Oannes; and stories of the flood. These Mesopotamian traditions were preserved in various genres: myth, epic, royal inscriptions, ritual texts, and Berossus' comprehensive work written in Greek. It is commonly held that the figure of Enoch in the apocalyptic literature is an amalgam of Mesopotamian traditions concentrated around an enigmatic biblical patriarchal personage. Enoch is the first "man of god" who, having ascended to heaven, observed the mysteries of the world and read the heavenly tablets, and on his return composed texts containing hidden knowledge. During the Hellenistic period, Enoch gradually became the preeminent Jewish *prōtos heuretēs*, corresponding to such Greek figures as Atlas and Prometheus.

Another branch of early apocalyptic literature which contains relics of Mesopotamian motifs is the so-called Book of Giants. While this text was found at Qumran in several late copies, Stuckenbruck dated its composition between the mid-third and the mid-second centuries B.C.E.[8] Later appearing also in a Persian version in Manichaean circles, it mentions the names of Gilgamesh and the monster Humbaba from the Gilgamesh epic. The Persian version probably also preserved the name of Utanapishtim, the hero of the flood.[9]

[7] W.G. Lambert, "Enmeduranki and Related Matters," *JCS* 21 (1967): 126–38; R. Borger, "Die Beschwörungsserie Bīt Mēseri und die Himmelfahrt Henochs," *JNES* 33 (1974): 183–96 (English translation in: *I Studied Inscriptions from Before the Flood: Ancient Near Eastern, Literary and Linguistic Approaches to Genesis 1–11* [ed. R.S. Hess and D.T. Tsumura: Winona Lake, IN: Eisenbrauns, 1994], 224–33).

[8] L.T. Stuckenbruck, *The Book of Giants from Qumran: Texts, Translation, and Commentary* (TSAJ 63; Tübingen: Mohr Siebeck, 1997), 28–31, with the earlier bibliography cited there. Nickelsburg, on the other hand, seems to favour a later date: G.W. Nickelsburg, *1 Enoch 1* (Hermeneia: Minneapolis: Fortress, 2001), 172–73.

[9] J.C. Reeves, "Utanapishtim in the Book of Giants?," *JBL* 112 (1993): 110–15; For the use of the Gilgamesh epic in the Book of Giants, see A.R. George, *The Babylonian Gilgamesh Epic: Introduction, Critical Edition and Cuneiform Texts* (NY/London: Oxford University Press, 2003), 60, 63; M. Schwartz, "Qumran, Turfan, Arabaic Magic, and Noah's Name," in *Charmes et sortilèges, magie et magiciens* (RO

VanderKam has assigned a special role in the cultural transmission to mantic literature: extispicy, the interpretation of dreams, physiognomy, and astral divination.[10] In arguing that significant elements of the apocalyptic worldview were inspired by the Mesopotamian divinatory discipline, he adduced the prophecies of Daniel as resembling the predictive clauses of the omens as well as the tone of the so-called "Mesopotamian Prophecies." This view has found general support in the study of apocalypticism.[11] It is supported by the findings of the present work, which connect the Jewish 364DCT with various segments of the Mesopotamian omen series EAE.

Numerous scholars have noted the Mesopotamian origin of elements in the Pseudepigrapha and Qumran literature, whether in the field of language, apocalyptic worldview, or science.[12] Since much of this material is embedded in the early Enochic literature, the Babylonian provenance of the Enochic circles has been the subject of particular attention. It should be noted that this is a very different issue

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14; ed. R. Gyselen; Bures-sur-Yvette: Groupe pour l'Étude de la Civilisation du Moyen-Orient, 2002), 231–38.

[10] See VanderKam, *Enoch and the Growth of an Apocalyptic Tradition*, 52–75; idem, *From Revelation to Canon: Studies in the Hebrew Bible and Second Temple Literature* (JSJSup 62; Leiden: Brill, 2000), 241–75; idem, "Mantic Wisdom in the Dead Sea Scrolls," *DSD* 4 (1997): 336–53. VanderKam was preceded by H.P. Müller, "Mantische Weisheit und Apokalyptik," in *Congress Volume Uppsala 1971* (VTSup 22; Leiden: Brill, 1972), 268–93.

[11] See, for example, the influential introduction by J.J. Collins, *The Apocalyptic Imagination* (Grand Rapids; Eerdmans, 1998²), 26–29. For an opposing view, see A. Bedenbender, *Der Gott der Welt tritt auf den Sinai: Entstehung, Entwicklung und Funktionsweise der frühjüdischen Apokalyptik* (ANTZ 8; Berlin: Institut Kirche und Judentum, 2000), 70–87; idem, "Jewish Apocalypticism: A Child of Mantic Wisdom?," *Henoch* 24 (2002): 189–96.

[12] See in general, M.J. Geller, "The Influence of Ancient Mesopotamia on Hellenistic Judaism," in *Civilizations of the Ancient Near East* (ed. J.M. Sasson; NY: Scribner's, 1995), 1:43–54. For more detailed discussions, see V.A. Hurowitz, "*Rwqmh* in the Damascus Document 4QD^e (4Q270) 7 i 14," *DSD* 9 (2002): 34–37; Collins, *The Apocalyptic Imagination*², 26–29; D. Dimant, "Apocalyptic Texts at Qumran," in *The Community of the Renewed Covenant: The Notre Dame Symposium on the Dead Sea Scrolls* (ed. E. Ulrich and J. VanderKam; Notre Dame, IN: Notre Dame University Press, 1994), 176–77; idem, "Old Testament Pseudepigrapha at Qumran," in *The Bible and the Dead Sea Scrolls: The Second Princeton Symposium on Judaism and Christian Origins* (ed. J.H. Charlesworth; Waco, Texas: Baylor University Press, 2006), 2:465; M.E. Stone, "The Book of Enoch and Judaism in the Third Century B.C.E.," in *Selected Studies in Pseudepigrapha and Apocrypha* (SVTP 9; Leiden: Brill, 1991), 190 and n. 20; P.S. Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," 238.

from the claim of a Mesopotamian origin for the *yaḥad*. While the formation of the latter took place, at the earliest, in the second century, the elusive "Enoch circle" may have been formed much earlier. Grelot, for instance, has consistently argued that the Mesopotamian traditions collected around the figure of Enoch date no later than the time of Ezra and Nehemiah.[13] In his opinion—supported also by Kvanvig—cultural contact was made exclusively on Babylonian soil. Kvanvig writes in this regard:

> One could consider the possibility that the Enochic scribes during a long period of time had access to Mesopotamian traditions, but it is hard to imagine how these traditions should be available in Palestine.[14]

Albani has further mapped the different types of knowledge incorporated into AB, claiming that the transfer of Mul.Apin-type astronomy constitutes the "missing link" which explains how the traditions concerning Enmeduranki and the *apkallū* reached Judaea from Babylon.[15] He emphasises a point originally made by Michael Stone—namely that, by the time this knowledge reached Jewish hands, it was already outdated in comparison with current Babylonian astronomical knowledge. Yet it was precisely the ancient nature of the material which caused the Enochic writers to consider it authoritative.[16] Albani contends that scientific knowledge was developed in priestly circles, to which also the Enochic authors belonged. The priests who conveyed this knowledge were exiled Jews (such as Ezra and Daniel), educated in Babylonian temples which functioned as centres of scholarship. Mul.Apin, EAE, and the Enmeduranki material were highly esteemed by the Jewish priests-scribes because of their antediluvian status, the authority attaching to them ensuring their continuing circulation long after their scientific methodology had become outdated.

Albani, Grelot, and Kvanvig all concur that the Babylonian-Jewish cultural contact took place solely on Babylonian soil, in close

[13] P. Grelot, "La légende d'Hénoch dans les apocryphes et dans la Bible," *RSR* 46 (1958), 195; similarly Kvanvig, *Roots of Apocalyptic*, 325–28. Kvanvig is of the opinion that the priestly writer of Gen 5:21–24 was familiar with the Enoch compositions, and that the Pentateuchal source P was authored by Jewish priests in Babylon.

[14] Kvanvig, *Roots of Apocalyptic*, 328; see also idem, "The Watchers' Story, Genesis and *Atra-ḫasīs*: A Triangular Reading," *Henoch* 24 (2002): 17–21.

[15] Albani, *Astronomie und Schöpfungsglaube*, 270.

[16] Ibid, 261ff.

proximity to the Restoration. Whatever knowledge appeared in later centuries had existed already earlier but remained "underground" during the intervening period. This depiction of the cultural contact is, in fact, that adopted in rabbinic circles: "R. Hanina said: The names of months came with them [i.e., the returnees] from Babylonia … R. Šimᶜon b. Lakiš said: Also the names of angels came with them from Babylonia" (*j. Roš Haš*. 56d).

Our knowledge concerning the transmission of knowledge into Jewish writings has now been further enhanced by the work of Henryk Drawnel.[17] Drawnel's recent study examines the section of the *Aramaic Levi Document* (ALD vv.32a–47) in which Isaac gives instructions to Levi concerning the accurate weights of the wood required for burning different types of animals on the altar, together with the amount of sacrificial material needed for the meal offering.[18] His findings indicate that the numbers and fractions in this section of ALD reflect a Babylonian-type system of sexagesimal numbers belonging to the educational curriculum at the Edubba.[19] The context of ALD signifies that the arithmetical instruction text was part of the priestly education of novitiate Jewish priests.

Developing this notion further in relation to the Aramaic AB, Drawnel notes the various series of numerical figures and fractions this document contains. He argues that, "The astronomical text that intends to calculate monthly moon illumination belongs to the priestly lore of didactic literature, in which simple arithmetical knowledge was used both for the sacrificial purposes and astronomical calculation."[20] Just as the arithmetical figures of ALD derived from Mesopotamian lexical lists such as UR.RA = *ḫubullum*, so the arithmetics of AB derive from EAE 14 and related texts. According to Drawnel, the presence of these texts in a pedagogic priestly context constitutes the interpretative key for understanding their original setting and purpose.

[17] H. Drawnel, *An Aramaic Wisdom Text from Qumran: A New Interpretation of the Levi Document* (JSJSup 86; Leiden: Brill, 2004); idem, "Priestly Education in the *Aramaic Levi Document (Visions of Levi)* and the *Aramaic Astronomical Book* (4Q208–211)," *RQ* 22.4 (2006): 547–74; idem, "Moon Computation in the *Aramaic Astronomical Book*," *RQ* 23 (2007): 3–41.

[18] Drawnel, *An Aramaic Wisdom Text from Qumran*, 280–93.

[19] Offerings are already measured by sexagesimal figures in Ezek 45:13–14 and 46:14. Ezekiel himself may have adopted this system from his Babylonian environment and the list in ALD may be a reemployment of his principles, of course.

[20] Drawnel, "Priestly Education," 561–62.

Even prior to the discovery of the Dead Sea Scrolls, W.F. Albright had assumed a Babylonian influence on the Essene community:

> It seems probable that the Essenes represent a sectarian Jewish group which had migrated from Mesopotamia to Palestine after the victory of the Maccabees. This theory would explain their interest in the virtues of plants and stones … [and] their attention to divination and astrology …[21]

Albright could not have possessed any knowledge concerning the Essenes' particular interest in astronomy without knowing of the Scrolls' existence. His views on Essene divination derive from the information provided by Josephus. His ascription of the provenance of this knowledge to Mesopotamia is slightly naïve, since, as shown below, most divinatory texts found at Qumran subscribed to general Hellenistic lore by the first century. Nonetheless, his estimation of a Mesopotamian milieu as a possible source of influence was fairly accurate—even if his dating of the contact to the period following the Maccabean revolt is erroneous, the better part of Mesopotamian knowledge in Jewish writings belonging to the third century B.C.E. and possibly even earlier.

Albright's rather radical—and difficult to substantiate—claim that the Essenes migrated from Babylonia was accepted to a certain degree by Jerome Murphy-O'Connor in 1974 and further supported by Philip Davies, who linked the emergence of the sect as recorded in CD to the Babylonian exile.[22] Yet it would be more accurate to speak of the Babylonian "roots" of the sect, as in Boccaccini's statement: "A Palestinian movement whose exegetical, halakhic and liturgical traditions are rooted in the exiled priesthood."[23]

[21] W.F. Albright, *From the Stone Age to Christianity* (Baltimore: Johns Hopkins University Press, 1940), 289. Albright restated his opinion in the introduction to the second edition, published after the discovery of the Scrolls: "I still maintain that the original Essenes came from Mesopotamia in the second century B.C., and were less affected by Hellenism" (NY: Doubleday, 1957), 3. See also W.F. Albright and C.S. Mann, "Qumran and the Essenes: Geography, Chronology and Identification of the Sect," in *The Scrolls and Christian Origins* (ed. M. Black; London: Nelson, 1969), 11–25.

[22] J. Murphy-O'Connor, "The Essenes and Their History," *RB* 81 (1974): 215–44; P.R. Davies, *The Damascus Covenant: An Interpretation of the "Damascus Document"* (JSOTSup 25; Sheffield: Academic Press, 1983), 32f, 36–47, 202–4; see also J.G. Campbell, "Essene-Qumran Origins in the Exile: A Scriptural Basis?," *JJS* 46 (1995): 143–56, esp. 149.

[23] G. Boccaccini, *Beyond the Essene Hypothesis: The Parting of the Ways between Qumran and Enochic Judaism* (Grand Rapids: Eerdmans, 1998), 126.

The final issue arising here relates to the presence of Babylonian divinatory scholarship in later mantic texts from Qumran. Although the fact that these texts date to the first century B.C.E. and thus more readily attest to general Hellenistic divination than to an earlier Babylonian method,[24] they nevertheless contain several indications of particular Babylonian elements which must be taken into account.

The astrological scroll 4Q318 is a typical example. Both sections of this text—the *selendromion* and the *brontologion*—can be connected with both Babylonian and Greek sources. The former is a list which locates the moon on the ecliptic on any given date of the 360-day year, with a daily advance of c. 13°. The contents of this list are paralleled in the Babylonian *Dodekatemoria*, dated to c. 400 B.C.E.[25] However, while all Babylonian texts of the late period conventionally begin the zodiac with Aries, the Qumran list in 4Q318 witnesses to a reconstructed but fairly certain beginning of the zodiacal circle in Taurus. Albani and Geller have argued that this concept originated in early Mesopotamian thought: in such texts as Mul.Apin 1 iv 33, the circle of "gods in the path of the moon" begins with the Pleiades, part of what was later called Taurus.[26] Although this list indeed opens with

[24] I have discussed the question of cultural provenance in J. Ben-Dov, "Babylonian Science in West Semitic Sources: The Case of Qumran," in *The Interactions of Ancient Astral Science* (ed. D. Brown; Bremen: Hempen, forthcoming). See also M. Popović, *Reading the Human Body: Physiognomics and Astrology in the Dead Sea Scrolls and Hellenistic–Early Roman Period Judaism* (STDJ 67; Leiden: Brill, 2007), 103–18.

[25] O. Neugebauer and A. Sachs, "The 'Dodekatemoria' in Babylonian Astrology," *AfO* 16 (1953): 65–66; H. Hunger and D. Pingree, *Astral Sciences in Mesopotamia* (HdO I, 44; Leiden: Brill, 1999), 30; L. Brack-Bernsen and J.M. Steele, "Babylonian Mathemagics: Two Mathematical Astronomical-Astrological Texts," in *Studies in the History of the Exact Sciences in Honour of David Pingree* (ed. C. Burnett et al.; Leiden: Brill, 2004), 95–121, esp. 119. My discussion of the *selendromion* profited from a correspondence with Helen Jacobus (University of Manchester), who has developed some new ideas concerning its interpretation.

[26] M.J. Geller, "New Documents from the Dead Sea: Babylonian Science in Aramaic," in *Boundaries of the Ancient Near East: A Tribute to Cyrus H. Gordon* (JSOTSup 273; ed. M. Lubetski, C. Gottlieb, and S. Keller; Sheffield: Academic Press, 1998), 224–29. Geller does not acknowledge the contribution of earlier writers: M.O. Wise, "Thunder in Gemini: An Aramaic Brontologion (4Q318) from Qumran," in *Thunder in Gemini and Other Essays on the History, Language and Literature of Second Temple Palestine* (JSPSup 15; Sheffield: JSOT Press, 1994), 13–50; M. Albani, "Der Zodiakos in 4Q318 und die Henoch-Astronomie," *Mitteilungen und Beiträge: Forschungsstelle Judentum* 7 (1993): 3–42; J.C. Greenfield and M. Sokoloff with appendices by D. Pingree and A. Yardeni, "An Astrological Text from Qumran (*4Q318*) and Reflections on Some Zodiacal Names," *RQ* 16 (1995): 507–25. Later treatments are the edition of 4Q318 by Greenfield and Sokoloff in DJD XXXVI, 259–

the Pleiades (MUL.MUL), followed by "The Bull of Heaven" ($^{mul}GU_4$.AN.NA), the zodiacal sign of Taurus was only identified as such several centuries later. Furthermore, Mul.Apin was not yet aware of the zodiac at all, since it records seventeen rather than twelve constellations "in the path of the moon."[27] We may therefore conclude that the peculiar starting point of the zodiac in 4Q318 must remain in doubt until a new source—whether Babylonian or Greek—is found to account for it.

In similar fashion, the *brontologion* from 4Q318 finds a parallel both in EAE (tablet 44) and in a later Greek astrological text, most probably based on earlier Greek models.[28] The scholar approaching this text is thus faced with a dilemma, typical of the cultural melting pot of the Hellenistic-Roman period where diverse cultural traditions amalgamated to produce a more-or-less universal divinatory teaching. While much of the latter originated in Mesopotamian materials, it subsequently underwent a lengthy series of modifications. What then remained of the Mesopotamian source?[29] This question is especially

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74 and M. Albani, "Horoscopes in the Qumran Scrolls," in *The Dead Sea Scrolls After Fifty Years* (ed. P.W. Flint and J.C. VanderKam; Leiden: Brill, 1999), 2:279–330. It is doubtful whether, as Geller claims (p. 226), the habit of beginning the zodiac in Taurus "was usual in Babylonia." Although some pre-mathematical texts indeed opened with the Pleiades—which later became part of Taurus—these were written before the invention of the zodiac. In contrast, all astronomical (Systems A and B) and astrological (*Dodekatemoria*, *Kalendertexte*) texts place the equinox point within Aries: see, for example, F. Rochberg, *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture* (Cambridge: Cambridge University Press, 2004), 129. Albani ("Der Zodiakos in 4Q318," n. 77), records some later Babylonian texts placing the spring equinox in Taurus, but admits that their value is ambiguous and finally suggests that the Taurus-beginning of the zodiac in 4Q318 originated in the third millennium B.C.E. (!) ("Der Zodiakos," 30–35, quoted in DJD XXXVI, 265 n. 11). The notion of an extremely early origin of Mul.Apin was raised in the past and refuted by Pingree in *AfO* 31(1984), 70–71. It would be difficult, moreover, to trace the origin of a unique text from first century B.C.E. Judaea to the astronomical reality in Mesopotamia in the early third millennium B.C.E. Wise's attempt (*Thunder in Gemini*, 39–48), to account for the beginning of the zodiac in Taurus by positing that 4Q318 is a *thema mundi* is unconvincing. It does not appear reasonable to see in 4Q318 an implementation of the precession of the equinoxes, this phenomenon only being a discovery of the mid-second century: see Albani, "Der Zodiakos," 23–26.

[27] For the early history of the zodiac, see Rochberg, *The Heavenly Writing*, 126–33; L. Brack-Bernsen and H. Hunger, "The Babylonian Zodiac: Speculation on its Invention and Significance," *Centaurus* 41 (1999): 280–92.

[28] DJD XXXVI, 271–72.

[29] See Geller, "New Documents from the Dead Sea: Babylonian Science in Aramaic," 229; similarly P.S. Alexander, "Bavli Berakhot 55a–57b: The Talmudic Dreambook in Context," *JJS* 46 (1995): 230–48, esp. 244. (My thanks are due to Dr. Gideon Bohak for this reference.)

pressing with respect to the Jewish material, which stands midway between East and West. The physiognomic texts from Qumran 4Q561 (Aramaic) and 4Q186 (Hebrew) constitute good examples of this problem: are they an offshoot of the Babylonian tradition or representative of the general divinatory culture of the Hellenistic East? In his detailed study, Popović was appropriately careful in his articulation:

> *4QPhysiognomy ar* may very well have had a Babylonian origin, but this cannot be proved on the basis of the text's form and content … It is possible to conceive of a process of transmission of physiognomic lore from Mesopotamia against such a background. But these factors do not necessarily lead to the conclusion that there was Babylonian influence on *4QPhysiognomy ar* and that physiognomic learning came to Palestine from Mesopotamia. Caution is advised. Jewish culture in Palestine during the Hellenistic-early Roman period was not influenced either from the East or from the West. It was not a matter of either/or, but rather, at times, of both.[30]

Another ambiguous case—in which no clear conclusion has yet been reached—is the so-called Qumran sundial. Glessmer and Albani, who "rediscovered" this object and first noted its possible use, interpreted it in light of Babylonian time-measuring techniques:

> If lines of mixing traditions should be drawn out at all, the measuring instrument could be called (similar to the Enoch-tradition), a witness for application of Mesopotamian astronomical concepts adapted to a western context.[31]

Glessmer and Albani acknowledged that the discovered object does not resemble any other sundial of the Hellenistic-Roman period—such as those unearthed on the Temple Mount in Jerusalem or the variety of sundials described in Vitruvius' treatise on architecture.[32] At the same time, we possess very little evidence concerning the use of sundials in Mesopotamia, where water clocks were primarily used for scientific

[30] Popović, *Reading the Human Body*, 112.

[31] U. Glessmer and M. Albani, "An Astronomical Measuring Instrument from Qumran," in *The Provo International Conference on the Dead Sea Scrolls* (STDJ 30; ed. D.W. Parry and E. Ulrich; Leiden: Brill, 1999), 442.

[32] Glessmer and Albani, "An Astronomical Measuring Instrument from Qumran," 439; Vitruvius, *de Architectura*, 9 §§7–8; S.L. Gibbs, *Greek and Roman Sundials* (New Haven: Yale University Press, 1976). Prof. Hanan Eshel has brought to my attention the discovery of another Roman-type sundial in Khirbet ʿEtri: see B. Zisu and A. Ganor, "Ḥorvat ʿEtri – the Ruins of a Second Temple Period Jewish Village on the Coastal Plain," *Qadmoniot* 35.1 (2002): 18–27 (Hebrew).

time measurement.[33] The shape of this object—with its graduation marks forming a full circle around the *gnomon*—is problematic for a sundial, only part of a circle normally being required for daily shadow-casting. For this reason, several scholars have suggested that the object cannot strictly be considered a sundial. As of now, the issue has still not been finally resolved.[34] Even if its identity as a sundial—the most probable likelihood—is accepted, its exact use and technological background require further investigation.

To sum up, the relevant material may be divided into three groups. The first comprises Mesopotamian elements which appear in early Enochic literature. A second group attests to the Babylonian mathematical-astronomical curriculum (ALD, AB, and the lunar rosters from Qumran). A third group—the later divinatory texts from Qumran (first century B.C.E. and onwards)—reflects knowledge of Hellenistic and Babylonian sources while also retaining a relative measure of independence from both these traditions. The most significant texts lie in the second group, the lunar texts from Qumran attesting to a distinct Mesopotamian teaching lacking any Greek parallels.

6.3 Aramaic Cultural Mediation

Our present discussion has proceeded on the assumption that scientific material was transmitted from Babylonian scholars to Jewish scholars through the medium of Akkadian. Given the consideration that mastery of the Akkadian language and cuneiform writing was diminishing in the first millennium B.C.E.—both in Judaea (if it was present there at all) and in Babylonia—this contact could only have taken place in limited periods during the Second Temple period. At the same time, it seems highly probable that the Aramaic language and culture played a mediating part in this cultural process. The "Aramaic hypothesis" is well accepted among scholars of apocalypticism, who assume that Babylonian science books existed in Aramaic prior to

[33] For the meagre evidence on the use of sundials, see Hunger and Pingree, *Astral Sciences in Mesopotamia*, 80.

[34] G.M. Hollenback, "The Qumran Roundel: An Equatorial Sundial?," *DSD* 7 (2000): 123–29; idem, "More on the Qumran Roundel as an Equatorial Sundial," *DSD* 11 (2004): 289–92; B. Thiering, "The Qumran Sundial as an Odometer Using Fixed Lengths of Hours," *DSD* 9 (2002): 347–63.

their appearance in Judaea. Thus Cana Werman with respect to the author of AB:

> A person who wishes to reject Hellenistic science will not base himself on Greek writings … it is reasonable to assume, therefore, that the books of astronomy that reached him were written in his language, Aramaic. Aramaic had been the language of the Persian Empire, in use already by the earlier Chaldean kingdom of Babylonia. It appears that the ancient Babylonian writings, written in Akkadian, were translated into Aramaic and some time afterwards reached Eretz Israel.[35]

Some scholars seek to strengthen the Syrian-Aramaic connection by appealing to the description of the flight to Damascus given in CD. Murphy-O'Connor and Dimant, for example, have reasserted the view that "Damascus" should be understood as a toponym—an actual place in Syria to which the early sectarians fled and whence they brought back cultural and religious knowledge.[36] This view finds support in the fact that the preeminent examples of Babylonian teaching in Judaea—ALD, AB, and the Book of Giants—are all written in Aramaic. In addition, palaeographers have noted that the scripts of some of the earliest scrolls from Qumran—including the earliest Enoch manuscript, 4Q201—resemble that of ancient Aramaic documents (e.g., from Palmyra). This circumstance may point to a relationship between Jewish scribes and Aramaic-language culture in the realm of scribal practices.[37]

[35] C. Werman, *Apocalyptic Literature of the Second Temple Period* (Tel Aviv: Ministry of Defense, 2003), 23 (my translation from the Hebrew). A similar reasoning is invoked by Philip Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," 238. Even Grelot, who, as demonstrated above, maintains that the Jews became familiar with the Babylonian materials only on Babylonian soil, does not rule out the possibility that some Phoenician or Syrian mediation was involved in the transmission process: P. Grelot, "La géographie mythique d'Hénoch et ses sources orientales," *RB* 65 (1958), 68.

[36] J. Murphy-O'Connor, "The Essenes and Their History," 221; D. Dimant, "Not Exile in the Desert but Exile in Spirit: The Pesher of Isa. 40:3 in the *Rule of the Community*," *Meghillot* 2 (2004), 26–27; cf. Boccaccini, *Beyond the Essene Hypothesis*, 126.

[37] Cross contends that "the script of 4QEx^{f} is … a protocursive script, developed in a locality, presumably Syria-Palestine, where a set of archaic features survived": see F.M. Cross, "The Development of the Jewish Scripts," in *The Bible and the Ancient Near East: Essays in Honor of W.F. Albright* (ed. G.E. Wright; NY: Doubleday, 1961), 155–57. Milik has stated with regard to 4Q201 that "it does not fit very well into the scribal traditions of the Jewish copyists of Judaea or even Egypt; the scribe would perhaps be dependent upon the Aramaic scripts and the scribal customs of Northern Syria or Mesopotamia": see J.T. Milik, *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* (Oxford: Clarendon, 1976), 140.

Aramaic mediation has not only been assumed by scholars of apocalypticism. The renowned Assyriologist Leo Oppenheim also held that the Arameans facilitated the spread of Mesopotamian knowledge—especially astronomy and divination.[38] The mutual relationship between Mesopotamian scholarship and Aramaic has been the subject of intense scholarly discussion.[39] The issue was recently reevaluated in a seminal study by Paul-Alain Beulieu, with an updated bibliography and new insights.[40] The essentials of this article are summarized below in so far as they are pertinent to the present study.

Aramaic scribes were present already in the Neo-Assyrian courts. This is attested both by the occurrence of west-Semitic names and by references to *ṭupšarru armû*.[41] That these scribes wrote in Aramaic and not only cuneiform is evidenced by Assyrian wall paintings (e.g., from Til Barsip), which depict a cuneiform scribe working alongside an Aramaic scribe, the latter writing with a pen on a scroll. Their activity, however, was restricted to royal correspondence and administrative texts and did not encompass literature and scholarship. A good illustration of the distribution of the literary materials in this period is provided by the eighth century B.C.E. finds from the Syrian city of Hama. The Akkadian writings there include royal letters as well as medical, magical, and astrological cuneiform tablets—while the Aramaic inscriptions primarily contain personal names and seal

[38] A.L. Oppenheim, *Letters from Mesopotamia* (Chicago: University of Chicago Press, 1967), 52.

[39] See the articles by P. Garelli, H. Tadmor, and J.C. Greenfield, in *Mesopotamien und seine Nachbarn: Politische und kulturelle Wechselbeziehungen im alten Vorderasien vom 4. bis 1. Jahrtausend v. Chr.* (ed. H.J. Nissen and J. Renger; Berlin: D. Reimer, 1987²), 437–82.

[40] P.A. Beulieu, "Official and Vernacular Languages: The Shifting Sands of Imperial and Cultural Identities in First-Millennium B.C. Mesopotamia," in *Margins of Writing, Origins of Cultures* (University of Chicago Oriental Institute Seminars 2; ed. S.L. Sanders; Chicago: Oriental Institute, 2006), 187–216. (E-book available at http://oi.uchicago.edu/pdf/OIS2.pdf.)

[41] An astronomer bearing the Aramaic (Hebrew?) name Ṭabiya sent an astronomical report in cuneiform from Babylon to Nineveh (SAA VIII §213). He is mentioned alongside a scholar with the Aramaic name Zakir. See also U. Koch-Westenholz, *Mesopotamian Astrology: An Introduction to Babylonian and Assyrian Celestial Divination* (Copenhagen: The Carsten Niebuhr Institute of Near Eastern Studies, 1995) 63, 70. Most importantly, later traditions speak of the Aramaic-speaking scribes Aḥikar and Tobit in the Assyrian court. For Aramaic scribes and culture in the NA period, see generally Beulieu, "Official and Vernacular Languages," 187–91.

impressions.[42] Although additional Aramaic texts may have been written on perishable materials, the distribution of the extant material confirms what we know from other sources.

In the Neo-Babylonian and Persian periods, Aramaic acquired a more central role in scribal culture, due in part to the geographical and social circumstances prevalent in Babylonia and the Persian Empire. Beulieu nonetheless concludes that "during that period [eighth–fourth centuries B.C.E.] Aramaic never became a dominant cultural vehicle but remained mostly a language of communication and administration."[43] Several actual exemplars of literary Aramaic writings from that period are extant. A Mesopotamian literary text in Aramaic has been preserved in a papyrus from Egypt (p. Amherst 63), written in Demotic script, presumably having been carried by Mesopotamian exiles passing through Northern Israel (Bethel) on their way to Egypt.[44] This important item notwithstanding, Beulieu maintains that, "it is dubious whether any significant corpus of cuneiform texts was ever translated into Aramaic."[45] Although the Babylonian heritage filtered down to subsequent generations, principally in the field of astrology and divination, this did not occur through the translation of whole compositions but by means of the survival of "some elements" of the Babylonian teaching. Geller makes a similar claim: "It cannot be expected that complete texts were translated from Akkadian to Aramaic"—only that scientific Akkadian terminology was absorbed into Aramaic and similar close languages.[46]

One of the most significant documents in this respect is an Aramaic incantation in cuneiform script from Hellenistic Uruk.[47] Geller and Müller-Kessler have recently studied this difficult text, the latter scholar being inclined to classify it as reflective of indigenous Aramaic culture and thus independent of the Babylonian magical

[42] M.S. Smith, "Biblical Narrative between Ugaritic and Akkadian Literature. Part II: Mesopotamian Impact on Biblical Narrative," *RB* 114 (2007), 196.

[43] Beulieu, "Official and Vernacular Languages," 208.

[44] Ibid, 197, with bibliography; cf. George, *The Babylonian Gilgamesh Epic*, 59.

[45] Beulieu, "Official and Vernacular Languages," 197.

[46] Geller, "Babylonian Science in Aramaic," 229 n. 23.

[47] M.J. Geller, "The Aramaic Incantation in Cuneiform Script (AO 6489 = TCL 6, 58)," *JEOL* 35–36 (1997/2000): 127–46; C. Müller-Kessler, "Die aramäische Beschwörung und ihre Rezeption in den Mandäisch-magischen Texten: Am Beispiel Ausgewählter aramäischer Beschwörungsformulare," in *Charmes et sortilèges, magie et magiciens* (RO 14; ed. R. Gyselen; Bures-sur-Yvette: Groupe pour l'Étude de la Civilisation du Moyen-Orient, 2002), 193–208, esp. 195–201.

tradition. As such, it constitutes a forerunner to the rich magical tradition in Mandaic, Jewish Babylonian Aramaic, and Late Antiquity Syriac. The presence of this text in cuneiform is indicative of the fact that only the surface of the mutual cultural discourse between Akkadian and Aramaic—particularly that which occurred in later periods of Mesopotamian history—is currently visible to us.

An important role must also be assigned to Aramaic in the transmission of Mesopotamian astronomy and divination to India through the auspices of the Persian Empire, although the background of this transmission is still obscure. The undeniable mark of Babylonian lore on the huge corpus of Late Antiquity Aramaic magic represents another sign of this interaction.[48] A further significant finding has come in the form of Aramaic ostraca bearing astrological and divinatory content, recently unearthed in the city of Mareša on the southern hill slopes of Judaea, (courtesy of Esther Eshel).[49]

The resulting picture indicates that, by the Hellenistic period, some Babylonian texts—especially relating to astrology and omina—had found their way into the Aramaic scribal culture not only in the form of scattered terms but also in more substantial formulations.

An altogether different situation appears to have obtained with regard to proper astronomical texts—such as ACT and non-mathematical astronomy. In this discipline, even the latest exemplars of astronomical texts and horoscopes from Babylonia were written in cuneiform, at a time when Akkadian had conspicuously ceased constituting a means of literary communication in all other literary

[48] C. Müller-Kessler, "Aramäische Beschwörungen und astronomische Omina in nachbabylonischer Zeit: Das Fortleben Mesopotamicher Kultur im vorderen Orient," in *Babylon: Focus Mesopotamischer Geschichte, Wiege früher Gelehrsamkeit, Mythos in der Moderne* (ed. J. Regner; Saarbrücken: Saarbrücker Druckerei und Verlag, 1999), 427–41; idem, "The Mandeans and the Question of their Origin," *ARAM* 16 (2004): 47–60; F. Rochberg, "The Babylonian Origins of the Mandaean Book of the Zodiac," *ARAM* 11–12 (1999/2000): 237–47. For an earlier view, see J.C. Greenfield and M. Sokoloff, "Astrological and Related Omen Texts in Jewish Palestinian Aramaic," *JNES* 48 (1989): 201–14.

[49] Attention should also be paid to scribal notations in some Late Babylonian texts copied from a *magallatu*, "parchment scroll"—a rather uncomfortable medium for the copying of cuneiform script. Such scrolls are primarily mentioned in economic texts, but are interestingly also cited in such scholarly texts as a copy of the omen series *šuma izbu* (see CAD M/I, p. 31, s.v. *magallatu*, and supplement in *RA* 72 [1978], 96) and a list of Mercury omens (MMA 86.11.287D). The latter was published by E. Reiner in *Literary and Scholastic Texts of the First Millennium B.C.* (CTMMA II; ed. I. Spar and W.G. Lambert; NY: Metropolitan Museum of Art, 2005), 182–83.

genres.[50] Whatever grounds existed for the production of cuneiform writing in this late period, its use in the writing of such documents as contracts, religious texts, and chronicles was defunct by the first century B.C.E.[51] The writing of astronomical texts, however, continued until at least 75 C.E., the last exemplars being astronomical almanacs.

The reason for this cultural phenomenon remains uncertain. Brown maintains that a market for old-style horoscopes and predictions in cuneiform existed in Babylonia until a very late date.[52] Much of this was due to the unique scribal culture prevalent in Babylonia. Astronomical texts were by definition difficult to translate because of their distinct vocabulary and style: the latter included not only the denotation of large numbers and elaborate fractions but also numerous technical terms in the form of logograms. In fact, as Brown notes, these texts were designed to be expressed by the cuneiform scribal tradition; considerable effort would have been demanded in order to produce sufficient scribal capacity to convey this knowledge in another language.

The scribal practices in the astronomical texts from Qumran attest to an inferior technical and graphic means available to the scribes of these texts in comparison with those of the ACT scribes. If such a simple Mul.Apin-type text as the EMLV was so badly transmitted, it would have been much more difficult to convey the eleven or so columns of an ACT text! Astronomy thus remained the last stronghold of cuneiform because translations into other languages using cursive scripts were not sufficiently efficient to properly transmit its content. Only around the first century C.E. do reasonable translations of Babylonian astronomy appear in Demotic and later Greek, thus sealing the fate of the already-vanishing cuneiform culture.

It is instructive to investigate the media employed for the transmission of Mesopotamian astronomical theories and observations

[50] See A. Sachs, "The Latest Datable Cuneiform Texts," in *Kramer Anniversary Volume* (AOAT 25; ed. B.L. Eichler et al.; Neukirchen-Vluyn: Neukirchener, 1976), 379–98.

[51] Beulieu views the late cuneiform writing as marking an "imaginary community": "Late Babylonian urban elites … created and maintained an imaginary community by means of schooling in a tradition that was intended to provide a cultural identity for themselves and the larger society" ("Official and Vernacular Languages," 209).

[52] D. Brown, "Increasingly Redundant – The Growing Obsolescence of the Cuneiform Script in Babylonia from 539 B.C. On" (forthcoming). I am grateful to Dr. Brown for sharing this manuscript with me.

to Egyptian and Greek culture during roughly the same period. Berossus is frequently considered to be a transmitter of System A to the Greek-speaking world.[53] As a Babylonian priest, he clearly acquired this knowledge in Akkadian rather than Aramaic. Some time later, Hipparchus was using Babylonian material—both observations taken from the diaries and theoretical methods.[54] Was he studying the Babylonian science in Aramaic translation? Were the diary excerpts he quotes translated into Aramaic? I tend to agree with Toomer, who argues that this knowledge reached Hipparchus via a personal contact—a scholar who conveyed the knowledge in some common language shared by both men. Since Hipparchus wrote in Greek, no formal translation into Aramaic ever took place.

Babylonian astronomy appears in Greek translation—alongside Demotic versions—considerably later, in Roman Egypt of the first centuries C.E.[55] Jones and Rochberg have pointed out the surprisingly prominent position of Babylonian-type astronomical texts in Egyptian papyri until as late as the fifth century C.E.[56] How did these texts reach Egypt? It would appear that Aramaic may have played a larger role in this process than normally assumed during this later period. To quote David Brown:

> The nature of the transfer was clearly that which occurs between experts, perhaps scholars, Babylonian or Egyptian, trained in Babylonian temples who came to work in Egyptian ones ... The small amount of surviving material from these centuries [last centuries B.C.E.] suggests that Demotic was the script in which this contact was first made manifest on the Egyptian side and we must reckon on the possibility that the vast majority of Greek material on astral science from Egypt drew for inspiration on Demotic versions of Babylonian precursors, and not on the cuneiform itself. We must also contend with the fact that … Aramaic quite possibly acted as an intermediary

[53] Pingree, "Legacies in Astronomy and Celestial Omens," 134.

[54] See Toomer, "Hipparchus and Babylonian Astronomy"; Rochberg, *The Heavenly Writing*, 241.

[55] For example, O. Neugebauer, "A Babylonian Lunar Ephemeris from Roman Egypt," in *A Scientific Humanist: Studies in Memory of Abraham Sachs* (ed. E. Leichty et al.; Philadelphia: Samuel Noah Kramer Fund, 1988), 301–4; A. Jones, "Babylonian Lunar Theory in Roman Egypt: Two New Texts," in *Under One Sky: Astronomy and Mathematics in the Ancient Near East* (AOAT 297; ed. J.M. Steele and A. Imhausen; Münster: Ugarit, 2002), 167–73. According to Prof. Joachim Quack, numerous additional astronomical texts in Demotic have been discovered and await publication.

[56] Rochberg, *The Heavenly Writing*, 34–35.

> between texts composed in cuneiform and those in Demotic or Greek. The influence of Jewish scholars … must also be taken in consideration.[57]

Drawnel's ideas concerning the *Sitz im Leben* of the Jewish scientific material may also be pertinent here (see above 6.2). Although he does not address the question of how and when such knowledge came into the possession of Jewish scribes, his contention regarding the temple setting of scholarly activity is significant. Temples hosted scribal and scientific activity throughout the Persian and Hellenistic periods in Babylonia.[58] Could Jewish scholars have studied at a temple academy in Babylonia? Or could such an institution have been established in Jerusalem? Moreover, in what period did this influence occur: close to the return from the Babylonian exile or possibly later? These questions are crucial not only for our understanding of the Jewish texts but also for the more general effort of tracing the path of Babylonian wisdom westwards.

The present study suggests that while divinatory compositions were evidently present in Aramaic garb—whether fully or partially translated—astronomical texts proper were far less amenable to translation. The earliest attestations for the translation of such literature appear in Demotic and Greek texts from Roman Egypt. Prior to this period, some individuals—such as Hipparchus—learnt Babylonian knowledge through personal, rather than institutional, contacts. The EMLV is a prime example of a simple astronomical text which was translated from Akkadian into Aramaic and then continued its existence in a (possibly priestly) Jewish environment.

6.4 Possible Contacts with Syrian Culture

Traditional Babylonian religion and worship did not cease with the fall of the Mesopotamian Empire but persisted into the Hellenistic period and even later.[59] Elements of Mesopotamian religion were

[57] D. Brown, "Greek Astral Science," in *The Interactions of Ancient Astral Science* (ed. D. Brown; Bremen: Hempen, forthcoming).

[58] See Rochberg, *The Heavenly Writing*, 209–36.

[59] See M.J.H. Linssen, *The Cults of Uruk and Babylon: The Temple Ritual Texts as Evidence for Hellenistic Cult Practices* (CM 25; Leiden: Brill and Styx, 2004), 167–68. For the persistence of classical Mesopotamian culture into the late period, see also the remarks by George, *The Babylonian Gilgamesh Epic*, 57–63; This case is

preserved in several cultural centres outside Mesopotamia, such as the Syrian cities of Palmyra, Dura Europos, Apamea-on-Orontes, and Harran.[60] The latter city especially was considered to be a focus of astral religion, possessing special relations with Mesopotamia, from the Old Babylonian period through to the Middle Ages. The moon worship practiced in Harran gained a prominent role in Assyrian religion during the Neo-Assyrian Empire.[61] The moon temple in Harran was renovated by the last Babylonian king, Nabunidus, who intended to institute the Syrian moon cult as the official religion of his Empire. Sources in Syriac (fourth–fifth centuries C.E.) attest to the existence of typical Babylonian cults in Harran and Edessa long after the demise of Akkadian.[62] Arabic sources as late as the thirteenth century treat Harran as an important source of pagan philosophical teaching, frequently related to astral cults and sometimes also associated with the well-known school of the "Sabians."[63] The city is not explicitly tied to Babylonian astronomy of the late period, however.[64]

In several studies, none of which have gained much scholarly attention, Jürgen Tubach sought to link the Jewish 364DY to the

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somewhat overstated in A. Annus, *The God Ninurta in the Mythology and Royal Ideology of Ancient Mesopotamia* (SAAS 14; Helsinki: Helsinki University Press, 2002), 187–202.

[60] For the first three cities, see Dalley, *The Legacy of Mesopotamia*, 49–53. For Harran, see briefly, ibid, 30, and primarily, J. Tubach, *Im Schatten des Sonnengottes: Des Sonnenkult in Edessa, Ḥarrān und Ḥaṭrā am Vorabend der christlichen Mission* (Wiesbaden: Harrassowitz, 1986), 32–50; J.N. Postgate, "Ḫarrān," *RlA* 4:122–25; M.J. Geller, "The Last Wedge," *ZA* 87 (1997), 55. For later periods, see T.M. Green, *The City of the Moon God: Religious Traditions of Harran* (Leiden: Brill, 1992). Cuneiform writing was preserved in Harran late into the Persian period, as attested by a tablet discovered in Tell Tawilan (Jordan): see S. Dalley, "Appendix a: The Cuneiform Tablet from Tell Tawilan," *Levant* 16 (1984): 19–22.

[61] S.W. Holloway, "Harran: Cultic Geography in the Neo-Assyrian Empire and its Implications for Sennacherib's 'Letter to Hezekiah' in 2 Kings," in *The Pitcher is Broken: Memorial Essays for G.W. Ahlström* (JSOTSup 190; ed. S.W. Holloway and L.K. Handy; Sheffield: Academic Press, 1995), 276–314; O. Keel and C. Uehlinger, *Gods, Goddesses and Images of God in Ancient Israel* (Edinburgh: T&T Clark, 1998; orig. German 1992), 287–98; O. Keel, *Goddesses and Trees, New Moons and Yahweh* (JSOTSup 261; Sheffield: Academic Press, 1998), 62–100.

[62] Green, *The City of the Moon God*, 57–60; Geller, "The Last Wedge," 53–56.

[63] Green, *The City of the Moon God*, 94–123.

[64] Three astronomical reports (SAA VIII §§ 181–183) were written by one Urad-Ea, most probably a priest of Sin in Harran: see Holloway, "Harran in the Neo-Assyrian Empire," n. 55. In contrast, Green's attempt to place a scholar named Nabu-rimmanu who is associated with the invention of System A in Harran is inconclusive.

Syrian culture of Late Antiquity.[65] The first example he adduced was the calendar of Baʿalbek-Heliopolis in Lebanon, where the Sun God was venerated as one of the primary gods of the pantheon.[66] The calendar of this particular city—together with those of other Levantine cities—was preserved in a group of medieval Greek manuscripts commonly called "hemerologies."[67] Despite their late date, it is customary to trace the origin of the material these contain to the Roman period. The Heliopolitan calendar included 365 days, divided into twelve months according to the "Enochic" order of 30–30–31 days, with the addition of a 31st day in month V of the year (called there Adar). Thus the months with 31 days are III, V, VI, IX, and XII. According to Tubach, this phenomenon indicates a remarkable similarity between the calendrical system of Baʿalbek and that reflected in *1 Enoch*.

Since Tubach opts for a very early source of the Heliopolitan calendar—as early as the Persian period—he thus perceives it as a potential source for the Enochic calendar. In contrast to other calendars contained in the hemerologies, the Heliopolitan calendar employs Aramaic month names. It also maintains a synchronization of the seasons with the division of the months, placing the "additional days" at the end of each season. This is in contrast to other Syrian calendars from the hemerologies, which place these days as a cluster at the end of the year or in other dissimilar constellations. Tubach surmises that Galilean Jews may have assimilated the Heliopolitan calendar at some point—possibly during the Hasmonean campaigns against the kingdom of Jethur—and transmitted it further in Jewish circles.[68]

This hypothesis faces several difficulties. Firstly, the Heliopolitan calendar consists of 365 rather than 364 days. Likewise, the Enochic-Qumran calendar names the months by ordinal numbers rather than by Aramaic month names. More conclusively, Tubach's assignment of the origin of the Heliopolitan calendar to the Persian period seems

[65] J. Tubach, "Der Kalender von *Baʿalbek*-Heliopolis," *ZDPV* 110 (1994): 181–89; idem, "Synkellos' Kalender der Hebräer," *Vigilae Christianae* 47 (1993): 379–89.

[66] For Heliopolitan religion, see Y. Hajjar, "Baalbek, grand centre religieux sous l'empire," *ANRW* 18.4 (1990): 2458–508.

[67] A.E. Samuel, *Greek and Roman Chronology: Calendars and Years in Classical Antiquity* (Handbuch der Altertumswissenschaft I, 7; Munich: C.H. Beck, 1972), 171–78.

[68] Tubach, "Der Kalender von *Baʿalbek*-Heliopolis," 185.

exaggerated. Given that all of the calendars in the hemerologies reflect the practices of the Roman period, why should this particular calendar come from 500 years earlier? This group of calendars rather reflects variations on the 365-day year—whether in its Egyptian or Julian form; caution must be practiced when connecting it with either the Mesopotamian scientific tradition or the Jewish apocalyptic one.[69]

Thanks to Tubach's erudition, however, we are informed of yet another source from this milieu: a calendar characterised by Syncellus as the "Hebrew Calendar."[70] This calendar contains 365 days, similarly divided into periods of 91 days, with the addition of day number 31 to the month of Adar. A comparison of the three calendars is presented in the table below.

	Days in the Year	**Names of Months**	**Place of 365th Day**
Enochic Calendar	364	By ordinal numbers	None
Baʿalbek	365	Aramaic (Syrian tradition)	Month V (Adar)
"Syncellus"	365	Aramaic (Syrian tradition)	Month XII (Adar) holds 32 days

TABLE 6.2: The Jewish 364DY and "Syrian" calendars

On the basis of this data, Tubach drew the following conclusions:

1. There was no direct contact between the Enochic and the "Syncellus" calendar; a later mediator may have inserted changes in the former to produce the latter.[71]

2. No connection exists between the Baʿalbek and the "Syncellus" calendars.[72]

[69] Cf. also Samuel, *Greek and Roman Chronology*, 171; U. Glessmer, "Calendars in the Qumran Scrolls," in *The Dead Sea Scrolls After Fifty Years* (ed. P.W. Flint and J.C. VanderKam; Leiden: Brill, 1999), 2:219.

[70] W. Adler and P. Tuffin, *The Chronography of George Synkellos: A Byzantine Chronicle of Universal History from the Creation* (Oxford: Oxford University Press, 2002), 9–10.

[71] Tubach, "Synkellos' Kalender der Hebräer," 383.

[72] Ibid, 383–84 and nn. 38, 39.

3. It is possible that the Baʿalbek calendar was the source of the Enochic one.[73]

Since the data for the Baʿalbek and the "Syncellus" calendars appears to correspond and both calendars differ considerably from the Enochic calendar, it is difficult to understand why Tubach opted for conclusion 3 but denied any connection between the two "Syrian" sources. In fact, the two objections he notes against the association of the Enoch calendar with that of Syncellus are valid against his own association of the Enoch calendar with the Heliopolitan one.

In contrast, the data in TABLE 6.1 appears to suggest altogether different conclusions. The calendars reported in Syncellus and the hemerologies reflect the enormous effect the Julian calendar reform exerted on local Levantine calendars.[74] The Jewish 364DCT was also affected by this reform, some later sources imposing a 365-day framework on sources originating in this tradition. The "Jewish" calendar reported by Syncellus may well be the 364DY after having undergone such modification. It is well known that Syncellus' chronography constitutes an important witness of long-suppressed Jewish apocalyptic traditions. Elsewhere in Syncellus, reports based on the chronology of *Jubilees* were refashioned according to the 365-day year. Furthermore, one cannot rule out the possibility that the data in the Heliopolitan calendar also initially related to a 364DY and was later modified into a 365-day framework, either in Heliopolis or as an *ad hoc* move by the authors of the hemerologies.

6.5 CUNEIFORM CULTURE, BABYLONIAN JEWRY, AND THE TRANSMISSION TO JUDAEA

In the history of Babylonian Jewry, the timeframe under discussion here—the late Persian and Hellenistic periods—represents a "black hole" between two relatively well-documented periods, the biblical and mishnaic-talmudic. In attempting to clarify our understanding of

[73] Ibid, 185: "… eröffnet sich somit zunächst einmal die einfach anmutende Möglichkeit, dass der Henochkalender im Prinzip eine Adaptation des heliopolitanischen Stadtkalenders wurde."

[74] For this effect, see S. Stern, *Calendar and Community: A History of the Jewish Calendar 2nd Century* BCE *– 10th Century* CE (Oxford: Oxford University Press, 2001), 42–44.

this extended period, a brief survey of our knowledge concerning cultural transmission between Babylonia and Judaea in the preceding and subsequent periods will serve us well.

Numerous parallels have been pointed out between material contained in the Hebrew Bible and Mesopotamian sources. These correspondences relate to the primordial narratives of Genesis 1–11, biblical law, psalmody, wisdom and prophecy, as well as to parallels between Mesopotamian historiography (royal inscriptions and chronicles) and the local Israelite discipline.[75] Mesopotamian culture exerted considerable influence in Canaan already during the period of globalised international relations in the mid-second millennium B.C.E. Its concrete presence in biblical literature, however, must be attributed to later cultural interaction, during the Neo-Assyrian and Neo-Babylonian Empires. In addition, some of the biblical material—such as the late prophetical books and possibly a large portion of the historiography—was written on Mesopotamian soil.[76]

Most of the parallels between biblical literature and Mesopotamian cognates are not strictly verbal parallels, for which one must assume a quotation of a Mesopotamian source in translation. The majority are rather elements contained in oral sources, whether legends and literary motifs, wisdom proverbs, or royal propaganda. In several cases, however, a more substantial contact can be assumed: Neo-Assyrian

[75] See the survey by Dalley, *The Legacy of Mesopotamia*, 57–83; H.P. Müller (ed.), *Babylonien und Israel: Historische, religiöse und sprachliche Beziehungen* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1991). Cf. also the methodological considerations raised by Lambert and Smith: W.G. Lambert, "A New Look at the Babylonian Background of Genesis," repr. in *I Studied Inscriptions from before the Flood: Ancient Near Eastern, Literary and Linguistic Approaches to Genesis 1–11* (ed. R.S. Hess and D.T. Tsumura; Winona Lake, IN: Eisenbrauns, 1994), 96–113; Smith, "Biblical Narrative between Ugaritic and Akkadian Literature."

[76] Obviously, we cannot relate here to the huge amount of literature on the subject. A recent publication pertinent to the impact of Mesopotamian rule on Israelite literature is D.S. Vanderhooft, *The Neo-Babylonian Empire and Babylon in the Latter Prophets* (HSMM 59; Atlanta: Scholars Press, 1999). For biblical law, see E. Otto, *Das Deuteronomium: Politische Theologie und Rechtsreform in Juda und Assyrien* (BZAW 284; Berlin: de Gruyter, 1999); D.P. Wright, "The Laws of Hammurabi as a Source for the Covenant Collection (Exodus 20:23–23:19)," *Maarav* 10 (2003): 11–87, esp. the appendix on pp. 58–67. For Babylonian scholarship in the Book of Daniel, see K. van der Toorn, "Scholars at the Oriental Court: The Figure of Daniel Against Its Mesopotamian Background" and S.M Paul, "The Mesopotamian Babylonian Background of Daniel 1–6," both in *The Book of Daniel: Composition and Reception* (VTSup 83; ed. J.J. Collins and P. Flint; Leiden: Brill, 2001), 1:37–54, 55–68.

vassal treaties in Deuteronomy, royal propaganda in prophetic literature, and quotations from the Gilgamesh Epic in the Book of Qoheleth.[77] Cuneiform inscriptions with religious-literary contents found in Canaan only come from the second millennium, the first millennium inscriptions being comprised primarily of administrative writings and royal stele. Such inscriptions cease altogether around the middle of the first millennium.[78]

Jewish authors who wrote during the Babylonian exile had contact with Babylonian scholarly traditions—as, for example, the divinatory institution described (rather pejoratively) in Isaiah 47 and Jeremiah 50–51.[79] More tangible contacts have been posited between such passages as Genesis 1, Ezekiel 1, and the scholarly text KAR 307.[80]

[77] M. Weinfeld, *Deuteronomy and the Deuteronomic School* (Oxford: Clarendon, 1972), 116–29; H.U. Steymans, *Deuteronomium 28 und die adê zur Thronfolgeregelung Assarhdons: Segen und Fluch im alten Orient und in Israel* (OBO 145; Fribourg: Universitätsverlag, 1995); Otto, Das Deuteronomium; C. Cohen, "Neo-Assyrian Elements in the First Speech of the Biblical Rab-Šāqê," *IOS* 9 (1979): 32–48; P. Machinist, "Assyria and its Image in the First Isaiah," *JAOS* 103 (1983): 719–37; A. Schaffer, "The Mesopotamian Background of Lamentations (sic!), 4:9–12," EI 8 (1967): 246–50 (Hebrew); idem, "New Light on the 'Three-Ply Cord'," EI 9 (1969), 159–60 (Hebrew); and cf. C.L. Seow, *Ecclesiastes* (AB; NY: Anchor Books, 1997), 64–65.

[78] The sole first-millennium cuneiform inscription possessing religious content is a fragment of a stone *Lamaštu* plaque from the shephelah: see W. Horowitz and T. Oshima, *Cuneiform in Canaan: Cuneiform Sources from the Land of Israel in Ancient Times* (Jerusalem: Israel Exploration Society and the Hebrew University, 2006), 126.

[79] Albani and Machinist have both suggested the religious polemics at the time of Nabunidus as the background of the prophecies of Second Isaiah: see M. Albani, *Der eine Gott und die himmlischen Heerscharen* (ABG 1; Leipzig: Evangelische Verlagsanstalt, 2000); P. Machinist, "Mesopotamian Imperialism and Israelite Religion: A Case Study from Second Isaiah," in *Symbiosis, Symbolism, and the Power of the Past: Canaan, Ancient Israel and Their Neighbors from the Late Bronze Age through Roman Palestina, etc.* (ed. W.G. Dever and S. Gitin; Winona Lake, IN: Eisenbrauns, 2003), 237–64.

[80] Kingsley, "Ezekiel by the Grand Canal"; Horowitz, *Mesopotamian Cosmic Geography*, 9–12; C. Uehlinger and S. Müller Trufaut, "Ezekiel 1, Babylonian Cosmological Scholarship and Iconography: Attempts at Further Refinement," *TZ* 57 (2001): 140–71, esp. 158–66; R. Kasher, *Ezekiel* (Miqra le-Israel; Tel Aviv: Am Oved, 2004), 1:11–12 (Hebrew). For other possible scientific material in the Hebrew Bible, see F. Hartenstein, "Wolkendunkel und Himmelsfeste: Zur Genese der Vorstellung des himmlischen Heiligtums JHWHs," in *Das biblische Weltbild und seine altorientalischen Kontexte* (FAT 32; ed. B. Janowski and B. Ego; Tübingen: Mohr Siebeck, 2001), 125–79; S.L. Sanders, "Old Light on Moses' Shining Face," *VT* 52 (2002): 400–6; W. Horowitz, "The Isles of the Nations: Genesis X and Babylonian Geography," in *Studies in the Pentateuch* (VTSup 41; ed. J.A. Emerton; Leiden: Brill, 1990), 35–43.

The name of an apparently Jewish scribe appears in the colophon of the scholastic text BM 47463, which partly parallels KAR 307.[81] This personage was called ^{m}še-ma-aʾ-iá mār ^{I}a-di-rum—i.e., "Šemaʿiah ben Adirum." Since this could quite conceivably represent a Jewish name from that period, it is not improbable that Jews were present in the Babylonian academies of the mid-first millennium B.C.E. Such a possibility is also implied in the narrative concerning the Babylonian education of the three exiled Jewish youths, Ḥanania, Mišaʾel, and ʿAzariah in the Book of Daniel: "… bring … youths without blemish, handsome, proficient in all wisdom, knowledgeable and intelligent, and capable of serving in the royal palace—and teach them the writings and the language of the Chaldeans" (Dan 1:4, NJPSV; cf. vv. 17, 20).[82] Although the current records only attest to Babylonian Jews as villagers or merchants in the Neo-Babylonian period, the above-quoted sources suggest that some of them also became part of the scribal institution.[83]

Additional clues and hypotheses with regard to Jewish "science" have been raised in previous scholarship. Stephen Lieberman has suggested that rabbinic hermeneutical techniques developed from those employed in the vast exegetical material written in cuneiform.[84] Tzvi Abusch has examined the Akkadian term *alaktu lamādu*, which originally meant "seeking an oracle" (NA period) but later came to convey the fate dictated to a person by the stars.[85] Abusch maintained

[81] A. Livingstone, *Mystical and Mythological Explanatory Works of Assyrian and Babylonian Scholars* (Oxford: Clarendon, 1986), 259–60; cf. idem, *Court Poetry and Literary Miscellanea* (SAA 3; Helsinki: Helsinki University Press, 1989), XXIV–XXV.

[82] See van der Toorn, "Scholars at the Oriental Court," 38–42. It is not entirely clear, however, whether the verses from Daniel reflect the reality of the Neo-Babylonian period or constitute a later Hellenistic fiction.

[83] For Babylonian Jewry in cuneiform literature, see R. Zadok, *The Jews in Babylonia during the Chaldean and Achaemenian Periods According to the Babylonian Sources* (Haifa: University of Haifa, 1979); idem, *The Earliest Diaspora: Israelites and Judeans in Pre-Hellenistic Mesopotamia* (Tel Aviv: Diaspora Research Institute, Tel Aviv University, 2002); Machinist, "Mesopotamian Imperialism and Israelite Religion," 255.

[84] S.J. Lieberman, "A Mesopotamian Background for the So-Called *Aggadic* 'Measures' of Biblical Hermeneutics?," *HUCA* 58 (1987): 157–225; cf. also Y. Elman, "Authoritative Oral Tradition in Neo-Assyrian Scribal Circles," *JANES* 7 (1975): 19–32. With the publication of numerous cuneiform "explanatory texts" and commentaries, this avenue of research is likely to produce new findings and insights.

[85] I.T. Abusch, "*Alaktu* and *Halakhah*: Oracular Decision, Divine Revelation," *HTR* 80 (1987): 15–42.

that this term was transmitted directly (without Aramaic mediation!) from the Babylonian divinatory discipline to Hebrew literature in the form of the Hebrew word הלכה, or more fully דרש הלכה. Like the cognate Babylonian term, the Hebrew דרש הלכה designates the quest for divine guidance (Torah). Abusch believes that Jewish scholars maintained contacts with Babylonian scholars, most probably around the period of the Exile, adopting some of their technical terms. Although it is difficult to assess to what degree the hypotheses proposed by Lieberman and Abusch accurately reflect the reality of the Late Babylonian period, they undoubtedly shed considerable light on the prevailing scholarly atmosphere.

The historical and cultural scene only becomes clearer as we approach the mishnaic period.[86] Ample evidence exists in this period concerning travelers from Babylonia to Eretz Israel and back, who transferred knowledge in both directions. Thus Gafni:

> This phenomenon [of immigrants from Babylonian to Eretz Israel] is unattested from the end of the period of Ezra and Nehemiah until after the fall of the Hasmonean state and the ascent of Herod. Throughout the Hellenistic and Hasmonean period we have no knowledge of a Jewish-Babylonian personality who acts in the framework of the leadership and society in Jerusalem or Eretz-Israel. It is only in Herodian times that the penetration of Babylonian Jews into society in Eretz-Israel is encountered.[87]

[86] See primarily the numerous articles by Aharon Oppenheimer, collected in his *Between Rome and Babylon: Studies in Jewish Leadership and Society* (ed. N. Oppenheimer; Tübingen: Mohr Siebeck, 2005). On the early roots of Babylonian Jewry, see I.M. Gafni, *The Jews of Babylonia in the Talmudic Era: A Social and Cultural History* (Jerusalem: Zalman Shazar Centre, 1990), 20–35, 52–81 (Hebrew); J. Neusner, *A History of the Jews in Babylonia. Vol. I – The Parthian Period* (Leiden: Brill, 1965), 1–67. For a history of the research, see I.M. Gafni, "Between Babylonia and the Land of Israel: Ancient History and the Clash of Ideologies in Modern Jewish Historiography," *Zion* 62 (1997): 213–42 (Hebrew).

[87] Gafni, *The Jews of Babylonia in the Talmudic Era*, 68 (my translation from the Hebrew). In note 56, Gafni hints at the presence of Babylonian exiles in Judaea during an earlier period. Such exiles are implied by the statement of Reš Lakiš (*b. Suk.* 20a, quoted in ibid, n. 66): "… he said: I would sacrifice myself to bring back to life R. Hiyya and his children, because in the ancient time, when the Torah was forgotten by Israel, Ezra came from Babylon, and reestablished it again; when afterwards it was again forgotten, Hillel the Babylonian came up from Babylonia and restored it again; and when it was again forgotten, came R. Hiyya and his children and restored it again." Basing his argument on Josephus' account of Hecataius (Jos.*CAp.* 1.194), Stuckenbruck (*The Book of Giants from Qumran*, 38–39) has suggested that a wave of Jewish immigration from Babylonia to Egypt and Phoenicia took place following Alexander's death. This passage is commonly interpreted, to the contrary, as depicting

Gafni considers tracing the cultural profile of Babylonian Jews in this early period—or characterising the spiritual education of such immigrants as Hillel the Elder at the end of the first century C.E.—to constitute an impossible task.[88]

In a series of studies, Mark Geller has attempted to bridge the gap between cuneiform culture and the fully-developed Jewish Babylonian diaspora of Late Antiquity by identifying ancient Mesopotamian terms, as well as scientific and divinatory traditions, in the Babylonian Talmud.[89] Geller points to the figure of the Jewish Babylonian sage Mar Samuel, famous for his astronomical and astrological capabilities. Samuel both maintained contacts with a Babylonian colleague bearing the suggestive name אבלט (probably: Ea-uballit) and frequented an academic institution called בי אבידן (*b. Šab.* 116a), possibly located in a local temple.[90] It is thus increasingly evident that cultural connections between Babylonia and Jewish culture extended beyond the well-documented period of Ezra and Nehemiah, on the one hand, and the talmudic period on the other hand. Qumran is only one region of this unexplored territory, which promises to be a fruitful field for future study.

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a wave of immigration *from* Judaea to Egypt and Phoenicia: see A. Kasher, *Against Apion: A New Hebrew Translation with Introduction and Commentary* (Jerusalem: Zalman Shazar Centre, 1996), 1:195–96 (Hebrew).

[88] Gafni, *The Jews of Babylonia in the Talmudic Era*, 68–76.

[89] Geller, "The Last Wedge," 56–58; idem, "Akkadian Medicine in the Babylonian Talmud," in *A Traditional Quest: Essays in Honour of Louis Jacobs* (JSOTSup 114; ed. D. Cohn-Sherbok; Sheffield: JSOT Press, 1991), 102–12; idem, "An Akkadian Vademecum in the Babylonian Talmud," in *From Athens to Jerusalem: Medicine in Hellenized Jewish Lore and in Early Christian Literature* (ed. S. Kottek and M. Horstmanshoff; Rotterdam: Erasmus, 2000), 13–33; idem, "Akkadian Healing Therapies in the Babylonian Talmud," *Max-Planck-Institut für Wissenschaftsgeschichte Preprint* 259 (2004): 1–60 (*non vidi*).

[90] Shaul Shaked (cited in Geller, "The Last Wedge," 57 and n. 55) has claimed that בי אבידן constitutes the Persian term for a temple, which fits the general fact that late cuneiform culture was preserved and taught in the temples. Although Milik (*The Books of Enoch*, 337) attempted to reconstruct a Jewish academic institution called בית חנוך, the textual sources do not warrant this endeavour.

6.6 ADOPTION OR ADAPTATION: BABYLONIAN SCIENCE IN QUMRAN CALENDARS

What benefit accrues from establishing contact between Qumran calendars and Babylonian astronomy? This question calls for reflections on the methodology of cross-cultural interactions. Let us open the discussion with a quote from Pingree, in regard to borrowings from Mul.Apin in Indian astronomy:

> … whatever influence the Indians received from Mesopotamia, it does not suffice to explain the whole of what they did in response; this is generally true of all transmissions of knowledge from one culture to another. There is always a need for adjustments that will make the foreign ideas fit in better with those of the recipient culture.[91]

Indeed, the Jewish material from Qumran does not resemble the Mesopotamian texts in all respects, either in its scribal form or its underlying ideology.[92] While Mesopotamian astronomical data is always presented in numerical symbols and tabular form, the pertinent Jewish texts (ALD, AB, 4Q320–321) are penned in an awkward type of continuous prose, lacking an important dimension of the original discipline. Furthermore, while fixed stars constitute a dominant factor in Mul.Apin and its related texts, they are almost entirely ignored in the Jewish discipline, whose focus was placed on lunar theory. In contrast to the increasing value attributed to observation in the Babylonian science, the Jewish texts clearly reflect a preference for schematic models. Additional differences stem from unique Jewish peculiarities, such as the preference for the heptadic number of fourteen "parts" of lunar visibility, over the more realistic division of fifteen steps of lunar visibility found in EAE 14. Scientifically speaking, therefore, whereas the Babylonian material is rightly called "astronomy," a large measure of the Jewish material is better identified as "calendar science."

Mark Elliot has challenged the "Babylonian influence" thesis, questioning the extent to which the original material persisted after it had been woven into the thick ideological texture of the receiving

[91] Pingree, *The Legacy of Mesopotamia*, 127.

[92] Albani has recorded numerous differences in *Astronomie und Schöpfungsglaube*, 264–65; see also M. Elliot, "Covenant and Cosmology in the Book of the Watchers and the Astronomical Book," *Henoch* 24 (2002), 26–28 and nn. 5, 6.

culture.[93] In his view, the Babylonian sources only provide the "scientific" aspect of the apocalyptic worldview, the "religious" facet being exclusively Jewish and emanating from a covenantal mode of thought. Within this framework, the scientific data lost its Mesopotamian conception of circular time and assumed an eschatological dimension. Moreover, even the scientific data of *1 Enoch* is based on local religious traditions rather than on foreign sources. The heavenly luminaries fulfil their task as part of the covenant theology—expanded in the apocalyptic tradition to include not only human covenanters but also the elements of the natural order. According to Elliot, the roots of this conception are found in Gen 1:16 and Jer 33:19–26, followed by *1 Enoch* 1–5.[94] On this view, the meticulous keeping of calendrical details was dictated by covenantal commitments rather than by a scientific drive to unveil the mysteries of nature. In Elliot's opinion, the statements on the lateness of the moon in AB constitute religious polemics against a deviant practice rather than scientific disagreements.

This reasoning does not give the Mesopotamian scientific texts their full due, however. When viewed in proper perspective, the source and the target texts share a considerable measure of cultural affinity. It would be anachronistic to define the Mesopotamian material as strictly scientific. These texts were never disconnected from the traditional Mesopotamian worldview and were constantly associated with myth, cult, and divination.[95] A good example of this claim is supplied by the mythological prologues embedded within EAE (discussed above 5.1.1.1), which *functionally* resemble the literary passages describing Creation within 4Q319 and 4Q320. Nor is the divine covenant with the heavenly luminaries a Jewish innovation, most probably already being existent in *Enūma Eliš* tablet V.[96] In similar fashion, the essential correlation of human moral conduct with

[93] Elliot, "Covenant and Cosmology."

[94] According to the analysis conducted by L. Hartman, *Asking for a Meaning: A Study of 1 Enoch 1–5* (Coniectanea Biblica, NT Series 12; Lund: Gleerup, 1979).

[95] Rochberg, *The Heavenly Writing*, 40–42.

[96] B. Landsberger and J.V. Kinnier Wilson, "The Fifth Tablet of *Enuma* Eliš," *JNES* 20-21 (1961/1962), 174—"*riksu* in line 6 which should be taken to convey more a legal implication or obligation or duty, rather than the notion of course, revolution." Further "covenantal" terminology in *Enūma Eliš* occurs in the root *naṣāru* and the imperative for the stars (V 7): *ana lā ēpiš anni lā egû manāma*, "so that (they will) not commit sin nor loosen in any way."

the natural order—as reflected in *1 Enoch* 80—is a common concept in Ancient Near Eastern thought.[97] To the extent that the Babylonian texts constitute the result of a fusion of science and religion, so also do such Jewish texts as AB and 4Q320.[98]

An important question remains concerning whether the Enochic authors were aware of the foreign origin of their teachings and whether they ever gave explicit expression to this question. Elliot justifiably claims that whatever was considered problematic in their eyes was immediately associated with the forbidden knowledge dispersed by the Watchers (*1 Enoch* 8, 69).[99] On the other hand, no remark can be found concerning the dubious origin of the mathematics in ALD or the astronomy in AB. This implies that these corpora were so closely emulated within the recipient apocalyptic tradition that no element of refashioning was required.

Whatever path Mesopotamian knowledge took before reaching Jewish authors—through Akkadian or Aramaic, in the Persian or Hellenistic periods—it became the fermenting agent for a vigorous Jewish literary creation in which a unique amalgam of theology and scientific models was created. Naturally, the subsequent development in Judaea followed different paths than those taken in Mesopotamia itself or in later Roman Egypt. Yet the stamp of the original Mesopotamian models remained evident in the later Jewish reverberations. Present-day scholarship is now unveiling these reverberations in all their glory.

[97] See primarily, H.H. Schmid, *Altorientalische Welt in der alttestamentlichen Theologie* (Zürich: Theologischer Verlag, 1974), 9–30, 31–63.

[98] Much more remains to be said concerning this matter, the present remarks merely indicating possible directions. See also A. Yoshiko Reed, *Fallen Angels and the History of Judaism and Christianity: The Reception of Enochic Literature* (Cambridge: Cambridge University Press, 2005), 67–69.

[99] Elliot, "Covenant and Cosmology," n. 7; Alexander, "Enoch and the Beginnings of Jewish Interest in Natural Science," 234–35.

CHAPTER SEVEN

SUMMARY AND CONCLUSIONS

7.1 THE JEWISH 364-DAY CALENDAR TRADITION

The Jewish sources which attest to the 364-day year form a quite coherent and continuous tradition. While such an assertion does not ignore the considerable changes and modifications which took place during the various stages of the tradition, it does suggest that the former need to be viewed from the proper perspective—namely, as the natural outcome of a living process.

The various Jewish sources which refer to the 364DY are unified by prominent thematic threads, already present to a large extent in *1 Enoch* 82. These include:

1. The hierarchy of time, the various time periods of which are led by supernatural "leaders"—whether stars, angels, or priests.

2. The fourfold-division of the year and the importance of the cardinal days. This concept remains central, despite differing views regarding the exact position of the cardinal days within the yearly ephemeris.

3. The septenary structure of the year and of related phenomena.

The Jewish 364DY is an essentially schematic year. Jewish authors and scholars found it particularly attractive due to the septenary order it imposed on the course of time. On the one hand, apocalyptic thinkers sought to ground the harmony of the cosmos within an eternal and divinely-ordained scheme. On the other, halakhic practitioners were concerned with preventing the Jewish festivals and sacrifices from falling on the Sabbath day. As these two interests coalesced in the communities related to Qumran (the Damascus covenanters and the *yaḥad*), the 364DY gained increasing prominence. This development helps explain why the Dead Sea Scrolls constitute the earliest literary attestation for counting the days of the week—much earlier than any references found in other Jewish writings. When the septenary scheme was eventually linked to priestly motifs *via* its association with the *mišmarot* cycle, it corresponded perfectly with the interests of the sect dwelling at Qumran.

Rather than any count of lunar phases or other astronomical elements, the 364DY became normative primarily due to its convenient schematic structure. Despite the centrality of astronomical calculations in the Scrolls—as well as in the present book—the calendrical principles noted above were held in too high regard to permit any change in actual practice. Nor did any fixed mechanism of intercalation exist in the 364-day calendar tradition. Modern scholars have frequently assumed that the lunar texts from Qumran, in particular, indicate ideological and halakhic differences within the 364DCT. However, even had a certain author devised a new theory of lunar visibility or cycle of priestly courses, instituted a new festival, or presented the yearly account in a different literary genre, such an action would have affected neither the principles underlying the year nor the essential unity of the practices which it dictated.

Furthermore, the 364-day calendar—constructed according to the above-mentioned principles—constituted the exclusive normative system for all the authors who dealt with it. Whatever lunar calculation is promulgated in the Scrolls, no competing lunar calendar, which would have changed the calendrical practice, is attested at any point.

7.2 The Composition of AB

The earliest Jewish document to include an explicit depiction of the 364DY is the Astronomical Book, which was later incorporated into *1 Enoch*. While this text parallels the models of traditional Mesopotamian astronomy quite closely, it also exhibits concrete Jewish traits. The earliest textual witness for AB is the Aramaic composition we have termed here the “Expanded Model of Lunar Visibility” (EMLV; formerly named the “Synchronistic Calendar” by Milik), attested in 4Q208 and parts of 4Q209. Although this composition contains most of the astronomical elements of the scientific worldview of AB, it does not include them all. Thus, for example, the EMLV does not indicate the length of daytime and night time, nor does it supply detailed information concerning the sun’s position on the horizon, measured by the system of twelve heavenly gates. The latter two elements are fully explicated in *1 Enoch* 72, presently extant only in the Ethiopic text. We thereby conclude that the EMLV was not intended to constitute an independent comprehensive astronomical treatise but simply represented one list in a broader astronomical corpus.

Together with several other, no longer extant, related early texts, the EMLV became the foundation stone of a novel Jewish scholarly tradition. Members of this tradition studied the original texts and copied them, as well as reworking them into more systematic astronomical treatises. This "rewriting" entailed not only a refashioning of the original documents but frequently also a measure of "creative" activity on the part of the compiler. The revisions of the raw data of the EMLV, which constitute the reworked treatises contained in the present AB, primarily involved a shift from lengthy daily rosters to the presentation of more "analytical" models. An additional difference—one which pertains more to content than to form—lies in the fact that whereas EMLV measures the time-periods of lunar visibility and invisibility, the reworked versions focus principally on a simpler (even trivial) integer: the amount of light in the lunar disc. A central element within the astronomical teaching—one directly dependent on the Mesopotamian origins of AB—was thereby obfuscated in transmission, probably also being further distorted in translation.

One section of AB, constituting a rather coherent astronomical treatise, is preserved in Aramaic at Qumran (parts of 4Q209, as well as 4Q210 and 4Q211) and also reflected in an Ethiopic version (*1 Enoch* 78–79, 82). An additional, possibly alternative, astronomical treatise is preserved in Ethiopic in chapters 72–75. The two treatises are merged in the present form of the Ethiopic AB. Although chapters 72–75 did not survive in Aramaic, no reason exists to believe that they were created solely in translation. The existence of parts of a reworked AB in Aramaic proves that AB was not the creation of later Greek or Ethiopic collectors but was already in existence prior to these translated versions. While it was probably not composed as early as the beginning of the second century B.C.E., it should certainly not be dated significantly later.

7.3 THE JEWISH REPRESENTATION OF MESOPOTAMIAN ASTRONOMY

Traditional Mesopotamian astronomy reached its peak in the early first millennium B.C.E. It was put into extensive practice in the late Neo-Assyrian period, during which initial moves were made towards the adoption of a new paradigm. The latter relied less on the traditional schemes and gave greater prominence to observation and prediction. The traditional discipline nonetheless continued to be copied and studied alongside the new texts.

The teaching of Mul.Apin was based on the (originally Old-Babylonian) "water-clock formula," a method which was applied to various astronomical phenomena, including the length of daytime and night time, heliacal risings and settings of fixed stars indicative of the onset of months and seasons, the sun's position on the horizon ("intercalation schemes"), shadow-length tables, and lunar visibility. While the latter element was explicated in EAE 14, it was shortened and aligned with the other elements of this text in Mul.Apin section l.

While the Jewish expression of this discipline reveals the clear stamp of the Mesopotamian original, it also displays some idiosyncratic Jewish principles. Generally speaking, the Jewish lines of development give greater prominence to the schematic dimension of the tradition, at times removing the discipline from astronomy and into the realm of sacred arithmetic. Below, we shall summarise the central transformations of the astronomical interests as they are embodied in the Jewish texts.

The Year

The schemes presented in Mul.Apin operate according to an ideal 360-day year. In one passage of this compendium (II ii 11–12), however, a 364-day year is invoked as part of a mathematical explanatory text, embedded within the "second intercalation scheme." This section of Mul.Apin relates to a cycle of three years, but does so only in passing. In contrast, the 364DY and—though to a lesser extent—the triennial cycle gradually became the cornerstones of the Enochic astronomical discipline. This process is well demonstrated within AB. While the models of AB were initially formulated for a 360-day year, at an early stage they underwent a modification which reflects the (theologically-preferable) 364DY. In contrast, the triennial cycle is not explicit in the versions of AB known to us, probably appearing only in the (presumed) original text of 74:10–16.

Jewish texts which depended on AB operated naturally on the basis of the 364DY, but were unfamiliar with the triennial cycle. This is true in respect to 4Q503 and probably also to 4Q334. In contrast, the author of the encrypted text 4Q317 was the first to create a fully-fledged triennial cycle. This subsequently served as the essential "building block" of the sexennial *mišmarot* cycle adopted in the Qumran calendrical scrolls and further developed in the *otot* list of 4Q319.

As Jewish authors sought to grant authority to what they perceived to be the essential mechanisms of nature, they took pains to anchor these mechanisms in the very moment of Creation. Such a concept already appears in the literary passages appended as prologues to the Mesopotamian series EAE. It is also paralleled quite closely in the Qumran texts 4Q319 and 4Q320, which embed both the 364DY and the priestly courses in the act of Creation. Such a notion is also reflected in rabbinic calendrical thought.

Stars

The first tablet of Mul.Apin—which relates to the fixed stars—is ignored in AB, probably on theological grounds. Instead, AB contains two paragraphs (75:1–3 and 82:4b–8, going back to a common original) which describe the role of the stars in the hierarchy of time and the positions of key stars in the gates of heaven on the cardinal days of the year. Since no star is mentioned by name in AB, the above statements must remain merely general in nature. Remnants of a more concrete stellar text are preserved in 4Q211 Enastr^{d} ii–iii. Although this passage contains a series of fractions relating to stellar visibility, its contents are not readily comprehensible. Jewish sources later than AB neglect to mention any aspect of the orbit of the stars.

Sun

Whereas Mul.Apin tracks the sun's position during the annual seasons exclusively *via* the three "Paths of Heaven," the Jewish AB reflects a six-fold division of the horizon: six gates in the east and six in the west. This notion—most clearly displayed in *1 Enoch* 72—may represent an attempt to express a projection of the twelve zodiacal signs eastwards and westwards, a concept unavailable to the authors of Mul.Apin.

Meagre evidence for a pro-solar religious disposition exists in AB and subsequent compositions from Qumran. In fact, the sole place where it may possibly be identified is the *Book of Jubilees*, which indeed stands out among other manifestations of the 364DCT in its pro-solar—or more accurately, anti-lunar—ideology.

Moon

The periods of lunar visibility, first elaborated in section 1 of Mul.Apin and in EAE 14, became a constitutive element of subsequent Babylonian astronomy. One of the earliest components of the astronomical diaries, the Lunar Six periods gradually developed as one of the impressive achievements of lunar theory in the ACT discipline. Interestingly, lunar phenomena also played a central role in AB and subsequent Jewish texts, albeit in very different form.

As Drawnel has recently pointed out, the EMLV contains a Jewish variation of the lunar visibility scheme known to us from EAE 14. This should come as no surprise, since such Roman authors as Pliny and Vettius Valens also found the lunar visibility scheme attractive. The unique Jewish twist given to this scheme was the division of the night into fourteen parts, rather than the customary fifteen. Since the number fourteen was most probably preferred due to its septenary traits, its adoption created enormous difficulties for the authors of such lunar texts as 4Q503 and 4Q317, who found it virtually impossible to account for a full month of 30 days with only 14 parts of visibility available.

EAE 14 and Mul.Apin relate solely to the time-periods of lunar visibility, failing to refer to spatial aspects of the moon's orbit. While Mul.Apin lists seventeen "gods in the path of the moon" and is thus aware of the ecliptic, it does not relate to the ecliptical elongation of the moon. In contrast, spatial aspects of the moon's orbit formed an integral element of EMLV and other versions of AB. The moon was tracked according to the system of heavenly gates, whereby its rising point on the horizon could be expressed at any given day of the month and the year. This data—only partially preserved in AB—is best encountered in the trajectories of this text represented in Ethiopic astronomy.

Since the moon's ecliptical elongation is only obliquely referred to in scattered notes within AB, it does not appear to have constituted an integral part of Enochic and Qumran astronomy. While it appears later in the *selendromion* of 4Q318, this document derives from a separate provenance.

One aspect of lunar visibility which gained specific prominence at Qumran was the "Lunar Three." Although the components of this triad were known in Mesopotamia as early as the composition of Mul.Apin, the group crystallised and came into frequent use only towards the end of the fifth century B.C.E.—significantly later than Mul.Apin. Identification of the presence of the Lunar Three in the *mišmarot* lunar texts from Qumran is highly significant. The lunar lists contained in 4Q320 and 4Q321 are best interpreted in the light of this set of lunar data, finding a parallel in the Babylonian lunar text BM 32327+ (ADRTB V §39). The evident disparities between the Babylonian and Jewish text are primarily due to the schematic nature of the latter, which contrast with the essentially observational nature of the former.

The recently-proposed "Lunar Three" interpretation of 4Q320–4Q321 runs counter to the near-consensus accepted regarding these scrolls by modern scholars since Milik. The *mišmarot* scrolls do not calculate the beginning of the month as occurring at full moon—nor, in fact, reckon the beginning of any lunar month at all. The lunar phases known as X and *dwq* recorded in 4Q320 and 4Q321 represent mere astronomical data rather than indications of cultic festivals. X is to be identified with the Mesopotamian KUR, denoting the day of last visibility towards the end of the lunation. The lunar phase *dwq* (probably derived from the root *dqq* "thin," on analogy with the Akkadian term *maššartu*) corresponds to the Mesopotamian NA, a phenomenon which occurs after full moon. Consequently, the literary passages at the beginning of 4Q319 and 4Q320 do not attest to a full-moon reckoning of the lunar month. In light of this fact, the evidence for a full-moon reckoning by the medieval sect of the Maghariah is insignificant with respect to the interpretation of the scrolls. Moreover, the preference in the *mišmarot* lunar texts for observing the last visibility (i.e., X or KUR) is paralleled by a series of astronomical texts from Mesopotamia, such as the Diviner's Manual and the later astronomical-calendrical compendium TU 11.

The various authors of the 364DCT debated the religious evaluation of the moon as a calendrical marker, this discussion reaching its peak approximately in the mid-second century B.C.E. While AB assumed the lunar orbit as a matter of course (*1 En* 74:12), the author of *Jubilees* held a diametrically-opposed opinion, condemning the unreliability of the moon in calendrical matters (6:36). The latter view failed to gain widespread support, however, as the 364DCT generally accepted the moon as a reliable marker of the march of Time—in similar fashion to the sun or any other heavenly object. The embellishment of the lunar model in 4Q317 substantiated this position, the calendrical scrolls subsequently incorporating the concept of the triennial cycle.

7.4 The Westwards Transmission of Babylonian Astronomy

The astronomical discipline represented in the Dead Sea Scrolls prefers schematic models to observational ones, emphasising the arithmetical dimension of nature as part of its apocalyptic worldview. Simultaneously, however, the cultural location in which this discipline developed makes it of considerable significance with regard to the history of science and ideas during the Hellenistic period. While the Jewish authors stand midway between the cultural realms of Mesopotamia and the Hellenistic world, their orientation is predominantly towards the former. The importance of this fact increases in light of the circumstance that their writings were composed and transmitted in the Hellenistic period, roughly between Hipparchus and Ptolemy—a period during which Babylonian science was transferred to the West via paths still unknown to us. Later Qumran texts which retained affinities to both Babylonian and Greek sources—such as the astrological scroll 4Q318—shed further light on this cultural process. The sundial discovered at Qumran constitutes a further focus of interest, in light of the fact that it does not resemble similar artifacts from the Greco-Roman world.

The Jewish discipline constitutes an example of a Levantine acculturation of Mul.Apin-type astronomy. Such a process also took place—albeit much earlier—in various other Ancient Near Eastern cultures from Egypt to India. The evidence from Qumran also points, however, to a significantly later cultural process, the presence of the

Lunar Three in Qumran indicating the adoption of concepts which arose subsequent to Mul.Apin. This circumstance suggests that the cultural transmission from Babylonia to Judaea took place later than formerly assumed.

The texts from Qumran also merit attention for their exemplification of the role of Aramaic as a cultural vehicle in the transmission of Babylonian science. The Aramaic EMLV is the closest one comes to a translation of an Akkadian astronomical text into a western vernacular during this early period. The importance of this cultural phenomenon is best perceived when compared to the presence of elements of cuneiform astrology in Aramaic texts of Late Antiquity: the debt of the latter tradition to cuneiform culture is both highly limited and significantly later than that of AB. The Aramaic AB is also significantly older than the translations of Lunar Six texts into Greek and Demotic found in Egypt, which date from the first centuries C.E. Thus although it is not clear whether Aramaic was used to translate Akkadian scientific compositions in their entirety, it undoubtedly served as a major medium for the transfer of scientific knowledge.

BIBLIOGRAPHY

Abegg, M.G. “Does Anyone Really Know What Time It Is? A Reexamination of 4Q503 in Light of 4Q317.” Pages 396–406 in *The Provo International Conference on the Dead Sea Scrolls*. STDJ 30. Edited by D.W. Parry and E. Ulrich. Leiden: Brill, 1999.

——. “The Calendar at Qumran.” Pages 145–64 in *Judaism in Late Antiquity. Part Five: The Judaism of Qumran: A Systematic Reading of the Dead Sea Scrolls.* HdO I, 56. Edited by A.J. Avery-Peck, J. Neusner, and B. Chilton. Leiden: Brill, 2001.

Abusch, I.T. “*Alaktu* and *Halakhah*: Oracular Decision, Divine Revelation,” *HTR* 80 (1987): 15–42.

Adler, W. and P. Tuffin. *The Chronography of George Synkellos: A Byzantine Chronicle of Universal History from the Creation*. Oxford: Oxford University Press, 2002.

Akavia, A.A. *The Calendar and its Chronological Use*: *A Reference Book for Technical and Historical Chronology*. Jerusalem: Magnes, 1953 (Hebrew).

Albani, M. “Zur Rekonstruktion eines verdrängten Konzepts: Der 364-Tage-Kalender in der gegenwärtigen Forschung.” Pages 79–125 in *Studies in the Book of Jubilees*. TSAJ 65. Edited by M. Albani, J. Frey, and A. Lange. Tübingen: Mohr Siebeck, 1996.

——. “Die lunaren Zyklen im 364-Tage-Festkalender von 4QMischmerot/4QS^{e},” *Mitteilungen und Beiträge. Forschungsstelle Judentum* 4 (1992): 3–47.

——. “Der Zodiakos in 4Q318 und die Henoch-Astronomie,” *Mitteilungen und Beiträge. Forschungsstelle Judentum* 7 (1993): 3–42.

——. *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch*. WMANT 68. Neukirchen-Vluyn: Neukirchener, 1994.

——. “‘Der das Siebengestirn und der Orion macht’ (Am 5,8): Zur Bedeutung der Plejaden in der israelitischen Religionsgescichte.” Pages 139–207 in *Religionsgeschichte Israels: formale und materiale Aspekte*. Edited by B. Janowski and M. Köckert. Gütersloh: Kaiser, 1999.

——. “Horoscopes in the Qumran Scrolls.” Pages 279–330 in Vol. 2 of *The Dead Sea Scrolls After Fifty Years*. 2 vols. Edited by P.W. Flint and J.C. VanderKam. Leiden: Brill, 1999.

——. *Der eine Gott und die himmlischen Heerscharen*. ABG 1. Leipzig: Evangelische Verlagsanstalt, 2000.

Albani, M., J. Frey, and A. Lange, eds., *Studies in the Book of Jubilees*. TSAJ 65. Tübingen: Mohr Siebeck, 1997.

Albright, W.F. *From the Stone Age to Christianity*. Baltimore: Johns Hopkins University Press, 1940.

Albright, W.F. and C.S. Mann. “Qumran and the Essenes: Geography, Chronology and Identification of the Sect.” Pages 11–25 in *The Scrolls and Christian Origins.* Edited by M. Black. London: Nelson, 1969.

Alexander, P.S. “Bavli Berakhot 55a–57b: The Talmudic Dreambook in Context,” *JJS* 46 (1995): 230–48.

——. “Enoch and the Beginnings of Jewish Interest in Natural Science.” Pages 223–43 in *The Wisdom Texts from Qumran and the Development of Sapiential*

Thought. BETL 159. Edited by C. Hempel, A. Lange, and H. Lichtenberger. Leuven: Leuven University Press, 2002.
Al-Rawi, F.N.H. and A. George. "Enūma Anu Enlil XIV and Other Early Astronomical Tablets," *AfO* 38–39 (1991–1992): 52–73.
Anbar, M. "La 'reprise'," *VT* 38 (1988): 385–98.
Annus, A. *The God Ninurta in the Mythology and Royal Ideology of Ancient Mesopotamia*. SAAS 14. Helsinki: Helsinki University Press, 2002.
Archi, A. "Tables de comptes eblaïtes," *RA* 83 (1989): 1–6.
Argall, R. *1 Enoch and Sirach: A Comparative Literary and Conceptual Analysis of the Themes of Revelation, Creation and Judgment*. SBLEJL 8. Atlanta: Scholars Press, 1995.
Auerbach, E. "Die babylonische Datierung im Pentateuch und das Alter des Priester-Kodex," *VT* 2 (1952): 334–42.
Baumgarten, J.M. *Studies in Qumran Law*. SJLA 24. Leiden: Brill, 1977.
——. "The Heavenly Tribunal and the Personification of Ṣedeq in Jewish Apocalyptic," *ANRW* X.1 (1979): 219–39.
——. "Some Problems of the Jubilees Calendar in Current Research," *VT* 32 (1982): 485–89.
——. "4Q503 (Daily Prayers) and the Lunar Calendar," *RQ* 12 (1987): 399–407.
——. "The Calendars of the Book of Jubilees and the Temple Scroll," *VT* 37 (1987): 71–78.
Beckwith, R.T. "The Essene Calendar and the Moon: A Reconsideration," *RQ* 15 (1991/92): 457–66.
——. *Calendar and Chronology, Jewish and Christian: Biblical, Intertestamental and Patristic Studies*. AGAJU 33. Leiden: Brill, 1996.
——. *Calendar, Chronology and Worship: Studies in Ancient Judaism and Early Christianity*. AJEC 61. Leiden: Brill, 2005.
Bedenbender, A. *Der Gott der Welt tritt auf den Sinai: Entstehung, Entwicklung und Funktionsweise der frühjüdischen Apokalyptik*. ANTZ 8. Berlin: Institut Kirche und Judentum, 2000.
——. "Jewish Apocalypticism: A Child of Mantic Wisdom?," *Henoch* 24 (2002): 189–96.
Ben-Dov, J. "The Initial Stages of Lunar Theory at Qumran," *JJS* 54 (2003): 125–38.
——. "The 364-day Year in Qumran and the Pseudepigrapha." In *ʿAl Megillot Qumran*. Edited by M. Kister. Jerusalem: Yad Ben Zvi, forthcoming (Hebrew).
——. "Jubilean Chronology and the 364-day Year," *Meghillot* 5–6 (2007): 49–59 (Hebrew).
——. "Tradition and Innovation in the Calendar of *Jubilees*." In *Enoch and the Mosaic Torah*: *The Evidence of Jubilees*. Edited by G. Boccaccini. Grand Rapids: Eerdmans, forthcoming.
——. "Babylonian Science in West-Semitic Sources: The Case of Qumran." In *The Interactions of Ancient Astral Sciences*. VSAO. Edited by D. Brown. Bremen: Hempen, forthcoming.
——. "Mishmarot." Entry in *Dictionary of Early Judaism* (forthcoming).
Ben-Dov J. and W. Horowitz. "The 364-day Year in Mesopotamia and Qumran," *Meghillot* 1 (2003): 3–26.
——. "The Babylonian Lunar Three in Calendrical Scrolls from Qumran," *ZA* 95 (2005): 104–20.
Ben-Shachar, Z. "The Calendar of the Judaean Desert Sect." PhD Diss., Tel Aviv University, 1975 (Hebrew).
Ben-Shammai, H. "Some Methodological Notes Concerning the Relationship between the Karaites and Ancient Jewish Sects," *Cathedra* 42 (1987): 69–84 (Hebrew).
Beulieu, P.A. "Official and Vernacular Languages: The Shifting Sands of Imperial and Cultural Identities in First-Millennium B.C. Mesopotamia." Pages 187–216

in *Margins of Writing, Origins of Cultures*. University of Chicago Oriental Institute Seminars 2. Edited by S.L. Sanders. Chicago: Oriental Institute, 2006.

Beyer, K. *Die aramäischen Texte vom Toten Meer*. Göttingen: Vandenhoeck and Ruprecht, 1984–1994.

Bickerman, E.J. *Chronology of the Ancient World*. London: Thames and Hudson, 1980^2.

Bidez J. and F. Cumont. *Les mages hellénisés: Zoroastre, Ostanès et Hystaspe, d'après la tradition Grecque*. Repr. Paris: Societe d'edition "Les belles lettres," 1973.

Black, J., A.R. George, and N. Postgate, eds. *A Concise Dictionary of Akkadian*. Wiesbaden: Harrassowitz, 2000.

Black, M. *Apocalypsis Henochi Graece*. SVTP 3. Leiden: Brill, 1970.

Black, M. in consultation with J.C. VanderKam. *The Book of Enoch or I Enoch: A New English Edition with Commentary and Textual Notes*. SVTP 7. Leiden: Brill, 1985.

Blau, L. "Observations sur l'histoire du culte Juif a propos d'un ouvrage recent," *REJ* 73 (1921): 142–44.

Boccaccini, G. *Beyond the Essene Hypothesis: The Parting of the Ways between Qumran and Enochic Judaism*. Grand Rapids: Eerdmans, 1998.

——. "The Solar Calendars of Daniel and Enoch." Pages 311–28 in Vol. 2 of *The Book of Daniel*. 2 vols. Edited by J.J. Collins and P.W. Flint. Boston: Brill, 2002.

Boccaccini, G. and J.J. Collins, eds., *The Early Enochic Literature*. JSJSup 121. Leiden: Brill, 2007.

Bord, L.-J. "L'adoption du calendrier babylonien au moment de l'exil." Pages 21–36 in *Le Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère*. JSJSup 112. Edited by C. Grappe and J. C. Ingelaere. Leiden: Brill, 2006.

Borenstein, H.Y. "The *tequfot* and their Development." Pages 33–58 in *S.A. Poznanski Memorial Volume*. Edited by S. Simonsohn. Warsaw and Leipzig: Harrassowitz, 1917.

Borger, R. "Die Beschwörungsserie Bīt Mēseri und die Himmelfahrt Henochs," *JNES* 33 (1974): 183–96. English translation, pages 224–33 in *I Studied Inscriptions from Before the Flood: Ancient Near Eastern, Literary and Linguistic Approaches to Genesis 1–11*. Edited by R.S. Hess and D.T. Tsumura. Winona Lake, IN: Eisenbrauns, 1994.

Böttrich, C. *Das Slavische Henochbuch.* JSHRZ V, 7. Gütersloh: Gütersloher, 1995.

Brack-Bernsen, L. "Goal Year Tablets: Lunar Data and Predictions." Pages 149–77 in *Ancient Astronomy and Celestial Divination*. Edited by N.M. Swerdlow. Cambridge, Mass.: MIT Press, 1999.

——. "Predictions of Lunar Phenomena in Babylonian Astronomy." Pages 5–19 in *Under One Sky: Astronomy and Mathematics in the Ancient Near East*. AOAT 297. Edited by J.M. Steele and A. Imhausen. Münster: Ugarit, 2002.

——. "The 'Days in Excess' from MUL.APIN: On the 'First Intercalation' and 'Water Clock' Schemes from MUL.APIN," *Centaurus* 47 (2005): 1–29.

Brack-Bernsen, L. and H. Hunger. "The Babylonian Zodiac: Speculation on its Invention and Significance," *Centaurus* 41 (1999): 280–92.

——. "TU 11: A Collection of Rules for the Prediction of Lunar Phases and of Month Lengths," *SCIAMVS* 3 (2002): 3–90.

Brack-Bernsen L. and J.M. Steele. "Babylonian Mathemagics: Two Mathematical Astronomical-Astrological Texts." Pages 95–121 in *Studies in the History of the Exact Sciences in Honour of David Pingree*. Edited by C. Burnett, J. P. Hogendijk, K. Plofker, and M. Yano. Leiden: Brill, 2004.

Bremner, R. "The Shadow Length Table in Mul.Apin." Pages 367–82 in *Die Rolle der Astronomie in den Kulturen Mesopotamiens: Beiträge zum 3. Grazer morgenländischen Symposion.* Edited by H.D. Galter. Graz: GrazKult, 1993.

Brin, G. "Regarding the Connection between the *Temple Scroll* and the *Book of Jubilees*," *JBL* 112 (1993): 108–9.

Britton, J.P. "Treatments of Annual Phenomena in Cuneiform Sources." Pages 21–78 in *Under One Sky: Astronomy and Mathematics in the Ancient Near East*. AOAT 297. Edited by J.M. Steele and A. Imhausen. Münster: Ugarit, 2002.

Brockelmann, C. *Lexicon Syriacum*. Repr. Hildesheim: Olms, 1966.

Brooke, G.J. "The Genre of 4Q252: From Poetry to Pesher," *DSD* 1 (1994): 160–79.

——. "The Rewritten Law, Prophets and Psalms: Issues for Understanding the Text of the Bible." Pages 31–40 in *The Bible as Book: The Hebrew Bible and the Judaean Desert Discoveries.* London: British Library, 2002.

Brown, D. *Mesopotamian Planetary Astronomy-Astrology*. CM 18. Groningen: Styx Publications, 2000.

——. "The Scientific Revolution of 700 BC." Pages 1–12 in *Learned Antiquity: Scholarship and Society in the Near-East, the Greco-Roman world, and the Early Medieval West*. Edited by A.A. MacDonald, M.W. Twomey and G.J. Reinink. Leuven: Leuven University Press, 2003.

——. "Increasingly Redundant – The Growing Obsolescence of the Cuneiform Script in Babylonia from 539 B.C. On" (forthcoming).

——. "Greek Astral Science." In *The Interactions of Ancient Astral Science*. Edited by D. Brown. Bremen: Hempen, forthcoming.

Brown, D., ed. *The Interactions of Ancient Astral Science*. Bremen: Hempen, forthcoming.

Brown, D., J. Fermor, and C. Walker. "The Water Clock in Mesopotamia," *AfO* 46–47 (1999–2000): 130–48.

Brownlee, W.H. "The Significance of 'David's Compositions,'" *RQ* 5 (1964–1966): 569–74.

Callaway, P.R. "The 364-day Calendar Traditions at Qumran." Pages 19–29 in Vol. 1 of *Mogilany 1989: Papers on the Dead Sea Scrolls Offered in Memory of Jean Carmignac*. 2 vols. Edited by Z.J. Kapera. Krakow: Enigma, 1993.

Campbell, J.G. "Essene-Qumran Origins in the Exile: A Scriptural Basis?," *JJS* 46 (1995): 143–56.

Caquot, A. "Remarques sur la 'Néoménie' dans l'ancient Israël," *Revue de l'histoire des religions* 158 (1960): 1–18.

Cassuto, U. *A Commentary on the Book of Genesis*. Trans. by I. Abrahams. Jerusalem: Magnes, 1964.

Charles, R.H. *The Book of Enoch or 1 Enoch.* Oxford: Clarendon, 1912.

Charlesworth J.H., ed. *Rule of the Community and Related Documents.* Tübingen-Louisville: J.C.B. Mohr, 1994.

Charlesworth, J.H. and F.M. Cross, eds. *Pseudepigraphic and Non-Masoretic Psalms and Prayers*. Tübingen-Louisville: J.C.B. Mohr, 1997.

Chazon, E. "The Function of the Qumran Prayer Texts: An Analysis of the Daily Prayers (4Q503)." Pages 217–25 in *The Dead Sea Scrolls: Fifty Years After their Discovery 1947–1997. Proceedings of the Jerusalem Congress, July 20–25, 1997* Edited by L.H. Schiffman, E. Tov, and J.C. VanderKam. Jerusalem: Israel Exploration Society, 2000.

Cohen, C. "Neo-Assyrian Elements in the First Speech of the Biblical Rab-Šāqê," *IOS* 9 (1979): 32–48.

Cohen, M.E. *The Cultic Calendars of the Ancient Near East*. Bethesda, Maryland: CDL Press, 1993.

Collins, J.J. *Apocalypticism in the Dead Sea Scrolls.* London/NY: Routledge, 1997.

——. *The Apocalyptic Imagination*. Grand Rapids: Eerdmans, 1998[2].

Collins J.J. and P.W. Flint, eds. *The Book of Daniel: Composition and Reception*. 2 vols. VTSup 83. Leiden: Brill, 2001.
Cross, F.M. "The Development of the Jewish Scripts." Pages 133–202 in *The Bible and the Ancient Near East: Essays in Honor of W.F. Albright*. Edited by G.E. Wright. NY: Doubleday, 1961.
Cryer, F.H. "The 360-Day Calendar Year and Early Judaic Sectarianism," *SJOT* 1 (1987): 116–22.
Dahmen, U. *Psalmen- und Psalter-Rezeption im Frühjudentum*. Leiden: Brill, 2003.
Dalley, S. "Appendix a: The Cuneiform Tablet from Tell Tawilan," *Levant* 16 (1984): 19–22.
Dalley, S., ed. *The Legacy of Mesopotamia*. Oxford: Oxford University Press, 1998.
Davidson, M.J. *Angels at Qumran: A Comparative Study of Enoch 1-36, 72-108 and Sectarian Writings from Qumran*. JSOTSup 11. Sheffield: Academic Press, 1992.
Davies, P.R. "Calendrical Change and Qumran Origins: An Assessment of VanderKam's Theory," *CBQ* 45 (1983): 80–89.
——. *The Damascus Covenant: An Interpretation of the "Damascus Document."* JSOTSup 25. Sheffield: University Press, 1983.
Depuydt, L. *Civil Calendar and Lunar Calendar in Ancient Egypt*. Leuven: Leuven University Press, 1997.
Dillmann, A. *Das Buch Henoch uebersetzt und erklärt*. Leipzig: Fr. Chr. Wilh. Vogel, 1853.
Dimant, D. "The Seventy Weeks Chronology (Dan 9,24–27) in the Light of New Qumranic Texts." Pages 57–76 in *The Book of Daniel in the Light of New Findings*. BETL 106. Edited by A.S. Van der Woude. Leuven: Leuven University Press, 1993.
——. "Apocalyptic Texts at Qumran." Pages 176–77 in *The Community of the Renewed Covenant: The Notre Dame Symposium on the Dead Sea Scrolls*. Edited by E. Ulrich and J. VanderKam. Notre Dame, IN: Notre Dame University Press, 1994.
——. "Not Exile in the Desert but Exile in Spirit: The Pesher of Isa. 40:3 in the *Rule of the Community*," *Meghillot* 2 (2004): 21–36.
——. "Old Testament Pseudepigrapha at Qumran." Pages 447–67 in Vol. 2 of *The Bible and the Dead Sea Scrolls: The Second Princeton Symposium on Judaism and Christian Origins*. 3 vols. Edited by J.H. Charlesworth. Waco, Texas: Baylor University Press, 2006.
——. "Two 'Scientific' Fictions: The so-called Book of Noah and the Alleged Quotation of Jubilees in CD 16:3–4." Pages 230–49 in *Studies in the Hebrew Bible, Qumran, and the Septuagint Presented to Eugene Ulrich.* VTSup 101. Edited by P.W. Flint, E. Tov, and J.C. VanderKam. Leiden: Brill, 2006.
Doering, L. "The Concept of the Sabbath in the Book of Jubilees." Pages 179–205 in *Studies in the Book of Jubilees*. Edited by M. Albani, J. Frey, and A. Lange. Tübingen: Mohr Siebeck, 1979.
——. "*Jub* 50:6–13 als Schlussabschnitt des *Jubiläenbuchs* – Nachtrag aus Qumran oder ursprünglicher Bestandteil des Werkes?," *RQ* 20 (2001–2): 359–87.
Drawnel, H. *An Aramaic Wisdom Text from Qumran: A New Interpretation of the Levi Document*. JSJSup 86. Leiden: Brill, 2004.
——. "Priestly Education in the *Aramaic Levi Document (Visions of Levi)* and the *Aramaic Astronomical Book* (4Q208–211)," *RQ* 22.4 (2006): 547–74.
——. "Moon Computation in the *Aramaic Astronomical Book*," *RQ* 23 (2007): 3–41.
Dubovský, P. "Cosmology in 1 Enoch," *Archiv orientální* 68 (2000): 208–11.
Dubs, J.-C. "4Q317 et le role de l'observation de la Pleine Lune pour la determination du temps à Qumrân." Pages 37–54 in *Le Temps et les Temps dans les littératures*

juives et chrétiennes au tournant de notre ère. Edited by C. Grappe and J.-C. Ingelaere. JSJSup 112. Leiden: Brill, 2006.
Düring, I., *Ptolemaios und Porphyrios über die Musik*. Göteborg, 1934. Repr. NY and London: Garland Publishing, 1980.
Ebling, E. and B. Meissner, eds. *Reallexikon der Assyriologie*. Berlin: de Gruyter, 1928–.
Eliade, M. *The Myth of the Eternal Return: Cosmos and History*. Trans. by W.R. Trask. NY: Harper and Row, 1959.
Elior, R. *The Three Temples: On the Emergence of Jewish Mysticism*. Trans. by D. Louvish. Oxford: Littman Library of Jewish Civilization, 2004.
Elliot, M. "Covenant and Cosmology in the Book of the Watchers and the Astronomical Book," *Henoch* 24 (2002): 23–38.
Elman, Y. "Authoritative Oral Tradition in Neo-Assyrian Scribal Circles," *JANES* 7 (1975): 19–32.
Erder, Y. "When did the Karaites first Encounter Apocryphic Literature akin to the Dead Sea Scrolls?," *Cathedra* 42 (1987): 54–68 (Hebrew).
——. "The Observance of the Commandments in the Diaspora on the Eve of the Redemption in the Doctrine of the Karaite Mourners of Sion," *Henoch* 19 (1997): 175–202.
——. *The Karaite Mourners of Zion and the Qumran Scrolls: On the History of an Alternative to Rabbinic Judaism*. Tel Aviv: Haqibutz haMeʾuhad, 2004 (Hebrew).
Eshel, H. "Hebrew in Economic Documents from the Judean Desert," *Lešonénu* 63 (2000/2001): 41–52 (Hebrew).
Evans, J. and J. Lennart Berggren. *Geminos's Introduction to the* Phenomena*: A Translation and Study of a Hellenistic Survey of Astronomy*. Princeton and Oxford: Princeton University Press, 2006.
Falk, D. *Daily, Sabbath and Festival Prayers in the Dead Sea Scrolls*. STDJ 27. Leiden: Brill, 1998.
Fermor J. and J.M. Steele. "The Design of Babylonian Waterclocks: Astronomical and Experimental Evidence," *Centaurus* 42 (2000): 210–22.
Fishbane, M. *Biblical Interpretation in Ancient Israel*. Oxford: Clarendon, 1985.
Fletcher-Louis, C. *All the Glory of Adam: Liturgical Anthropology in the Dead Sea Scrolls*. STDJ 62. Leiden: Brill, 2002.
Flint, P.W. *The Dead Sea Psalms Scrolls and the Book of Psalms*. Leiden: Brill, 2005.
Flint, P.W. and J.C. VanderKam, eds. *The Dead Sea Scrolls After Fifty Years*. 2 vols. Leiden: Brill, 1999.
Fossum, J. "The Magharians: A Pre-Christian Jewish Sect and its Significance for the Study of Gnosticism and Christianity," *Henoch* 9 (1987): 303–44.
Frahm, E. "Royal Hermeneutics: Observations on the Commentaries from Ashurbanipal's Libraries at Nineveh," *Iraq* 66 (2004): 45–50.
Gafni, I.M. *The Jews of Babylonia in the Talmudic Era: A Social and Cultural History*. Jerusalem: Zalman Shazar Centre, 1990 (Hebrew).
——. "Between Babylonia and the Land of Israel: Ancient History and the Clash of Ideologies in Modern Jewish Historiography," *Zion* 62 (1997): 213–42 (Hebrew).
Galil, G. "The Babylonian Calendar and the Chronology of the Last Kings of Judah," *Bib* 72 (1991): 367–78.
Galter H.D., ed. *Die Rolle der Astronomie in den Kulturen Mesopotamiens. Beiträge zum 3. Grazer morgenländischen Symposion*. Graz: GrazKult, 1993.
García Martínez, F. *Qumran and Apocalyptic: Studies on the Aramaic Texts from Qumran*. STDJ 9. Leiden: Brill, 1992.
——. "Calendarios en Qumran (II)," *EstBib* 54.4 (1996): 532–52.

García Martínez, F. and E.J.C. Tigchelaar. *The Dead Sea Scrolls Study Edition*. 2 vols. Leiden: Brill, 1997.

Geller, M.J. “Akkadian Medicine in the Babylonian Talmud.” Pages 102–12 in *A Traditional Quest: Essays in Honour of Louis Jacobs*. JSOTSup 114. Edited by D. Cohn-Sherbok. Sheffield: JSOT Press, 1991.

——. “The Influence of Ancient Mesopotamia on Hellenistic Judaism.” In *Civilizations of the Ancient Near East*. 4 vols. Edited by J.M. Sasson. Peabody, MA: Hendrickson, 1995, 1:43–54.

——. “The Last Wedge,” *ZA* 87 (1997): 43–95.

——. “The Aramaic Incantation in Cuneiform Script (AO 6489 = TCL 6, 58),” *JEOL* 35–36 (1997/2000): 127–146.

——. “New Documents from the Dead Sea: Babylonian Science in Aramaic.” Pages 224–29 in *Boundaries of the Ancient Near East: A Tribute to Cyrus H. Gordon*. JSOTSup 273. Edited by M. Lubetski, C. Gottlieb, and S. Keller. Sheffield: Academic Press, 1998.

——. “An Akkadian Vademecum in the Babylonian Talmud.” Pages 13–33 in *From Athens to Jerusalem: Medicine in Hellenized Jewish Lore and in Early Christian Literature*. Edited by S. Kottek and M. Horstmanshoff. Rotterdam: Erasmus, 2000.

——. “Akkadian Healing Therapies in the Babylonian Talmud,” *Max-Planck-Institut für Wissenschaftsgeschichte Preprint* 259 (2004): 1–60.

George, A.R. *The Babylonian Gilgamesh Epic: Introduction, Critical Edition and Cuneiform Texts*. New York and London: Oxford University Press, 2003.

Gibbs, S.L. *Greek and Roman Sundials*. New Haven: Yale University Press, 1976.

Gignoux, P. *Incantations magiques syriaque*. Louvain: E. Peeters, 1987.

Gillet-Didier, V. “Calendrier lunaire, calendrier solaire et gardes sacerdotales: recherches sur 4Q321,” *RQ* 20 (2001–2002): 171–205.

Glessmer, U. “Explizite Aussagen über kalendarische Konflikte in Jubiläenbuch: Jub 6,22–32.33–38.” Pages 127–64 in *Studies in the Book of Jubilees*. Edited by M. Albani, J. Frey, and A. Lange. Tübingen: Mohr Siebeck, 1996.

——. “Das astronomische Henoch-Buch als Studienobjekt,” *BN* 36 (1987): 69–129.

——. *Die ideale Kultordnung: 24 Priesterordnungen in den Chronikbüchern, den kalendarischen Qumrantexten und in synagogalen Inschriften*. Habilitationschrift, Hamburg, 1995.

——. “The Otot-Texts (4Q319) and the Problem of Intercalations in the Context of the 364-day Calendar.” Pages 125–64 in *Qumranstudien: Vorträge und Beiträge der Teilnehmer des Qumranseminars auf dem internazionalen Treffen der Society of Biblical Literature, Münster, 25–26. Juli 1993*. Edited by H.J. Fabry, A. Lange, and H. Lichtenberger. Göttingen: Vandenhoeck and Ruprecht, 1996.

——. “Horizontal Measuring in the Babylonian Astronomical Compendium mul.apin and in the Astronomical Book of 1Enoch,” *Henoch* 18 (1996): 259–82.

——. “Calendars in the Dead Sea Scrolls.” Pages 213–78 in Vol. 2 of *The Dead Sea Scrolls After Fifty Years*. 2 vols. Edited by P.W. Flint and J.C. VanderKam. Leiden: Brill, 1999.

Glessmer U. and M. Albani. “An Astronomical Measuring Instrument from Qumran.” Pages 407–42 in *The Provo International Conference on the Dead Sea Scrolls*. STDJ 30. Edited by D.W. Parry and E. Ulrich. Leiden: Brill, 1999.

Green, T.M. *The City of the Moon God: Religious Traditions of Harran*. Leiden: Brill, 1992.

Greenfield, J.C. and M. Sokoloff. “Astrological and Related Omen Texts in Jewish Palestinian Aramaic,” *JNES* 48 (1989): 201–14.

Greenfield, J.C. and M. Sokoloff, with appendices by D. Pingree and A. Yardeni. “An Astrological Text from Qumran (*4Q318*) and Reflections on Some Zodiacal Names,” *RQ* 16 (1995): 507–25.

Greenfield, J.C., M.E. Stone, and E. Eshel. *The Aramaic Levi Document: Edition, Translation, Commentary*. SVTP 19. Leiden: Brill, 2004.
Grelot, P. "La légende d'Hénoch dans les apocryphes et dans la Bible," *RSR* 46 (1958): 5–26, 180–210.
——. "La géographie mythique d'Hénoch et ses sources orientales," *RB* 65 (1958): 33–69.
Hajjar, Y. "Baalbek, grand centre religieux sous l'Empire," *ANRW* 18.4 (1990), 2458–508.
Halevi Frankel, A. *Encyclopaedia Hebraica*. (Jerusalem, 1949-1983). s.v. "Calendar" (לוח). 21:346.
Hartenstein, F. "Wolkendunkel und Himmelsfeste: Zur Genese der Vorstellung des himmlischen Heiligtums JHWHs." Pages 125–79 in *Das biblische Weltbild und seine altorientalischen Kontexte*. FAT 32. Edited by B. Janowski and B. Ego. Tübingen: Mohr Siebeck, 2001.
Hartman, L. *Asking for a Meaning: A Study of 1 Enoch 1–5*. Coniectanea Biblica. NT Series 12. Lund: Gleerup, 1979.
Hartum, E.S. "Enoch." Pages 1–144 in *Ḥezyonot 1. Ha-Sepharim Ha-Hitsonim*. Tel Aviv: Yavneh, 1967.
Herbert, E.D. and E. Tov, eds. *The Bible as Book: The Hebrew Bible and the Judaean Desert Discoveries*. London: The British Library, 2002.
Hess, R.S. and D.T. Tsumura, eds. *I studied Inscriptions from Before the Flood: Ancient Near Eastern, Literary and Linguistic Approaches to Genesis 1–11*. Winona Lake, IN: Eisenbrauns, 1994.
Hollenback, G.M. "The Qumran Roundel: An Equatorial Sundial?," *DSD* 7 (2000): 123–29.
——. "More on the Qumran Roundel as an Equatorial Sundial," *DSD* 11 (2004): 289–92.
Holloway, S.W. "Harran: Cultic Geography in the Neo-Assyrian Empire and its Implications for Sennacherib's 'Letter to Hezekiah' in 2 Kings." Pages 276–314 in *The Pitcher is Broken: Memorial Essays for G.W. Ahlström*. JSOTSup 190. Edited by S.W. Holloway and L.K. Handy. Sheffield: Academic Press, 1995.
Holst, S. and J. Høgenhaven. "Physiognomy and Eschatology: Some More Fragments of 4Q561," *JJS* 57 (2006): 26–43.
Horowitz, W. "The Isles of the Nations: Genesis X and Babylonian Geography." Pages 35–43 in *Studies in the Pentateuch*. VTSup 41. Edited by J.A. Emerton. Leiden: Brill, 1990.
——. "Two New Ziqpu-Star Texts and Stellar Circles," *JCS* 46 (1994): 89–98.
——. "The 360 and 364 Day Year in Ancient Mesopotamia," *JANES* 24 (1996): 35–44.
——. *Mesopotamian Cosmic Geography*. Winona Lake, Ind.: Eisenbrauns, 1998.
——. "The 364 Day Year in Mesopotamia, Again," *NABU* 1998/49, 49–51.
Horowitz, W. and T. Oshima. *Cuneiform in Canaan: Cuneiform Sources from the Land of Israel in Ancient Times*. Jerusalem: Israel Exploration Society and the Hebrew University, 2006.
Høyrup, J. "How to Educate a Kapo, or: Reflections on the Absence of a Culture of Mathematical Problems in Ur III." Pages 121–45 in *Under One Sky: Astronomy and Mathematics in the Ancient Near East*. AOAT 297. Edited by J.M. Steele and A. Imhausen. Münster: Ugarit, 2002.
Huber, P.J. and J.P. Britton. "A Lunar Six Text from 591 B.C.," *WZKM* 97 (2007). *Festschrift Hermann Hunger*, 213–17.
Hunger, H. *Astrological Reports to Assyrian Kings*. SAA 9. Helsinki: University of Helsinki Press, 1992.
Hunger, H. and A. Sachs. *Astronomical Diaries and Related Texts from Babylonia.* Vols. 1–5. Österreichische Akademie der Wissenschaften, philosophisch-

historische Klasse. Vienna: Oesterreichischen Akademie der Wissenschaften, 1998–2001.
——. “Non-mathematical Astronomical Texts and Their Relationships.” Pages 77–96 in *Ancient Astronomy and Celestial Divination*. Edited by N.M. Swerdlow. Cambridge, Mass.: MIT Press, 1999.
Hunger, H. and D. Pingree. *Mul.apin: An Astronomical Compendium in Cuneiform*. AfOBei 24. Horn, Austria: Berger, 1989.
——. *Astral Sciences in Mesopotamia*. HdO I, 44. Leiden: Brill, 1999.
Hunger, H. and E. Reiner. “A Scheme for Intercalary Months from Babylonia,” *WZKM* 67 (1975): 21–28.
Hurowitz, V.A. “*Rwqmh* in the Damascus Document 4QD^{e} (4Q270), 7 i 14,” *DSD* 9 (2002): 34–37.
Isaac, E. “1 (Ethopic Apocalypse of) Enoch.” Pages 5–89 in Vol. 1. of *The Old Testament Pseudepigrapha*. 2 vols. Edited by J.H. Charlesworth. NY: Doubleday, 1983.
Jackson, D. *Enochic Judaism: Three Defining Paradigm Exemplars*. LSTS 49. London: T&T Clark, 2004.
Janowski, B. “Tempel und Schöpfung: Scöpfungstheologische Aspekte der priesterschriftlichen Heiligtums Konzeption.” Pages 214–46 in *Gottes Gegenwart in Israel: Beiträge zur Theologie des Alten Testaments*. Neukirchen-Vluyn: Neukirchener, 1993.
Jastrow, M. *A Dictionary of the Targumim, the Talmud Babli and Yerushalmi, and the Midrashic Literature*. NY: Chorev, 1926.
Jaubert, A. “Le calendrier des Jubilés et de la secte de Qumrân. Ses origins bibliques,” *VT* 3 (1953): 250–64.
——. “Le calendrier des Jubilés et les jours liturgiques de la semaine,” *VT* 7 (1957): 35–61.
——. *The Date of the Last Supper*. Trans. by I. Rafferty. Staten Island: Alba House, 1965.
Jones, A. “The Adaptation of Babylonian Methods in Greek Numerical Astronomy,” *Isis* 82 (1991): 441–53.
——. “Evidence for Babylonian Arithmetical Schemes in Greek Astronomy.” Pages 77–94 in *Die Rolle der Astronomie in den Kulturen Mesopotamiens: Beiträge zum 3. Grazer morgenländischen Symposion*. Edited by H.D. Galter. Graz: GrazKult, 1993.
——. “Babylonian Lunar Theory in Roman Egypt: Two New Texts.” Pages 167–74 in *Under One Sky: Astronomy and Mathematics in the Ancient Near East*. AOAT 297. Edited by J.M. Steele and A. Imhausen. Münster: Ugarit, 2002.
Joüon, P. *A Grammar of Biblical Hebrew*. Translated and revised by T. Muraoka. Roma: Pontificio Instituto Biblico, 2000.
Kahana, A., “1 Enoch.” Pages 19–101 in Vol. 1 of *Ha-Sepharim Ha-Hitsonim*. Edited by A. Kahana. Tel Aviv: Yavneh, 1937.
——. ed. *Ha-Sepharim Ha-Hitsonim*. Tel Aviv: Yavneh, 1937.
Kasher, A. *Against Apion: A New Hebrew Translation with Introduction and Commentary*. 2 vols. Jerusalem: Zalman Shazar Center, 1996 (Hebrew).
Kasher, M.M. *Torah Shelemah*. NY: Beit Torah Shelemah, 1949^{2} (Hebrew).
Kasher, R. *Ezekiel*. Miqra le-Israel. Tel Aviv: Am Oved, 2004.
Katzoff, R. and B.M. Schreiber. “Week and Sabbath in Judaean Desert Documents,” *SCI* 17 (1998): 102–14.
Keel, O. *Goddesses and Trees, New Moons and Yahweh*. JSOTSup 261. Sheffield: Academic Press, 1998.
Keel, O. and C. Uehlinger. *Gods, Goddesses and Images of God in Ancient Israel*. Edinburgh: T&T Clark, 1998 (orig. German 1992).

Kingsley, P. "Ezekiel by the Grand Canal: Between Jewish and Babylonian Tradition," *JRAS* Series 3, Vol. 3 (1992): 339–46.
Kirk, G.S., J.E. Raven, and M. Schofield. *The Presocratic Philosophers*. Cambridge: Cambridge University Press, 1983[2].
Kister, M. "Levi = Light," *Tarbiz* 45 (1976): 327–30 (Hebrew).
——. "Concerning the History of the Essenes," *Tarbiz* 56 (1987): 1–18 (Hebrew).
——. "Some Aspects of Qumranic Halakhah." Pages 571–88 in Vol. 2 of *The Madrid Qumran Congress.* 2 vols. STDJ 11. Edited by J. Trebolle Barrera and L. Vegas Montaner. Leiden: Brill, 1992.
——. "Studies in 4QMiqsat Ma'asei HaTorah and Related Texts," *Tarbiz* 68 (1999): 317–71 (Hebrew).
——. "Three Unknown Hebrew Words in Newly-Published Texts from Qumran," *Lešonénu* 63.1–2 (2000/2001): 35–40 (Hebrew).
——. "5Q13 and the *ʿavodah*: A Historical Survey and Its Significance," *DSD* 8 (2001): 136–48.
——. "Syncellus and the Sources of *Jubilees* 3," *Meghillot* 1 (2003): 127–33 (Hebrew).
Klengel, H. "Vorstellungen von Zeit und Zeitmessung und der Blick auf vergangenes Geschehen in der Überlieferung des alten Mesopotamien." Pages 6–26 in *Vom Herrscher zur Dynastie: Zum Wesen kontinuierlicher Zeitrechnung in Antike und Gegenwart*. VSAO 1. Edited by H. Falk. Bremen: Hempen, 2002.
Knibb, M.A. *The Ethiopic Book of Enoch: A new Edition in the Light of the Aramaic Dead Sea Fragments*. Oxford: Clarendon, 1978.
——. "Interpreting the Book of Enoch: Reflections on a Recently Published Commentary," *JSJ* 33 (2002): 437–50.
——. "Which Parts of 1 Enoch Were Known to Jubilees? A Note on the Interpretation of Jubilees 4.16–25." Pages 254–62 in *Reading from Right to Left: Essays on the Hebrew Bible in Honour of David J.A. Clines*. JSOTSup 373. Edited by J. Cheryl Exum and H.G.M. Williamson. Sheffield: Academic Press, 2003.
Koch, J. "Kannte man in Mesopotamien das 364 Tage-Jahr wirklich seit dem 7. Jahrhundert v. Chr.?," *NABU* 1997/119, 109–12.
Koch, K. *Vor der Wende der Zeiten: Beiträge zur apokalyptischen Literatur: Gesammelte Aufsätze Band 3*. Edited by U. Glessmer and M. Krause. Neukirchen-Vluyn: Neukirchener, 1996.
Koch, K. and U. Glessmer. "Neumonds-Neujahr oder Vollmonds-Neujahr? Zu spätisraelitischen Kalender-Theologien." Pages 114–36 in *Antikes Judentum und Frühes Christentum: Festschrift für Hartmut Stegemann zum 65. Geburtstag*. BZNW 97. Edited by B. Kollmann, W. Reinbold, and A. Steudel. Berlin: Walter de Gruyer, 1999.
Koch-Westenholz, U. *Mesopotamian Astrology: An Introduction to Babylonian and Assyrian Celestial Divination*. Copenhagen: The Carsten Niebuhr Institute of Near Eastern Studies, Museum Tusculanum Press, University of Copenhagen, 1995.
Koehler, L. and W. Baumgartner. *The Hebrew and Aramaic Lexicon of the Old Testament*. Leiden: Brill, 1999.
Kutsch, E. "Die Solstitien im Kalender des Jubiläenbuches and in äth. Henoch 72," *VT* 12 (1962): 205–7.
Kutscher, E.Y. *The Language and Linguistic Background of the Isaiah Scroll (1QIs[a])*. STDJ 6. Leiden: Brill, 1974.
Kvanvig, H.S. *Roots of Apocalyptic: The Mesopotamian Background of the Enoch Figure and of the Son of Man*. WMANT 61. Neukirchen-Vluyn: Neukirchener, 1988.
——. "The Watchers' Story, Genesis and *Atra-ḫasīs*: A Triangular Reading," *Henoch* 24 (2002): 17–21.

Lambert, W.G. “Enmeduranki and Related Matters,” *JCS* 21 (1967): 126–38.
——. “A New Look at the Babylonian Background of Genesis.” Pages 96–113 in *Inscriptions from before the Flood*. Edited by R.S. Hess and D.T. Tsumura. Winona Lake, IN: Eisenbrauns, 1994.
Landsberger, B. *Der kultische Kalender der Babylonier und Assyrer*. Leipzig: J.C. Hinrichs’sche Buchhandlung, 1915.
Landsberger B. and J.V. Kinnier Wilson. “The Fifth Tablet of *Enūma Eliš*,” *JNES* 20–21 (1961–1962): 154–79.
Langerman, T. “A Great Light in Midheaven,” *Meghillot* 4 (2006): 203–6 (Hebrew).
Lefkovits, J.K. *The Copper Scroll 3Q15: A Reevaluation. A New Reading, Translation, and Commentary*. STDJ 25. Leiden: Brill, 2000.
Leitz, C. *Studien zur ägyptischen Astronomie*. ÄA 49. Wiesbaden: Harrassowitz, 1989.
——. *Tagewählerei. Das Buch ḥ3t nḥḥ pḥ.wy ḏt und verwandte Texte*. ÄA 55. Wiesbaden: Harrassowitz Verlag, 1994.
Lenzi, A. “The Secrets of the Gods and Society: Studies in the Origins, Guarding and Disclosure of Secret Knowledge in Ancient Mesopotamia and Biblical Israel.” PhD Diss., Brandeis University, 2006.
Leslau, W. *Concise Dictionary of Geʿez*. Wiesbaden: Harrassowitz, 1989.
Levine, B.A. “From the Aramaic Enoch Fragments: The Semantics of Cosmography,” *JJS* 33 (1982): 311–26.
Levinson, B.M. “‘You Must not Add Anything to what I Command You’: Paradoxes of Canon and Authorship in Ancient Israel,” *Numen* 50 (2003): 1–51.
Lewin, B.M., ed. *Otsar ha-Gaonim: Thesaurus of the Gaonic Responsa and Commentaries.* Vol 3: Tractate Roš Haššana. Jerusalem: The Hebrew University Press Association, 1932.
Lewy, H. and L. Lewy. “The Origin of the Week and the Oldest West Asiatic Calendar,” *HUCA* 17 (1942–1943): 1–152c.
Licht, Y. *The Rule Scroll*. Jerusalem: Bialik Institute, 1965 (Hebrew).
Lieberman, S.J. “A Mesopotamian Background for the So-Called *Aggadic* ‘Measures’ of Biblical Hermeneutics?,” *HUCA* 58 (1987): 157–225.
Lieven, von A. “Divination in Ägypten,” *Altorientalische Forschungen* 26 (1999): 77–126.
Lim, T.H., L. Hurtado, and A.G. Auld, eds. *The Dead Sea Scrolls in their Historical Context*. London: T&T Clark, 2000.
Linssen, M.J.H. *The Cults of Uruk and Babylon: The Temple Ritual Texts as Evidence for Hellenistic Cult Practices*. CM 25. Leiden: Brill and Styx, 2004.
Livingstone, A. *Mystical and Mythological Explanatory Works of Assyrian and Babylonian Scholars*. Oxford: Clarendon, 1986.
——. *Court Poetry and Literary Miscellanea*. SAA 3. Helsinki: Helsinki University Press, 1989.
Machinist, P. “Assyria and its Image in the First Isaiah,” *JAOS* 103 (1983): 719–37.
——. “Mesopotamian Imperialism and Israelite Religion: A Case Study from Second Isaiah.” Pages 237–64 in *Symbiosis, Symbolism, and the Power of the Past: Canaan, Ancient Israel and Their Neighbors from the Late Bronze Age through Roman Palestaina.* Edited by W.G. Dever and S. Gitin. Winona Lake, IN: Eisenbrauns, 2003.
Maher, M.M. *Targum Pseudo-Jonathan on Genesis*. The Aramaic Bible. Collegeville: Liturgical Press, 1992.
Maier, J. “Shîrê ʿÔlat ha-Shabbat: Some Observations on their Calendric Implications and on their Style.” Pages 543–60 in Vol. 2 of *The Madrid Qumran Congress.* 2 vols. STDJ 11. Edited by J. Trebolle Barrera and L. Vegas Montaner. Leiden: Brill, 1992.

Martin, F. *Le livre d'Hénoch: Traduit sur le texte éthiopien*. Paris: Letouzey et Ané, 1906.
Martone, C. "Some Observations on New *Mishmarot* Texts from Qumran." Pages 443–49 in *The Provo International Conference on the Dead Sea Scrolls*. STDJ 30. Edited by D.W. Parry and E. Ulrich. Leiden: Brill, 1999.
Milgrom, J. *Leviticus 23–27*. Anchor Bible. NY: Doubleday, 2001.
Milik, J.T. "Fragments grecs du livre d'Hénoch [p.Oxy.XVII 2069]," *Chronique d'Egypt* 46 (1971): 321–43.
——. *The Books of Enoch: Aramaic Fragments of Qumran Cave 4*. Oxford: Clarendon, 1976.
Morgenstern, M. "The Meaning of *beit moladim* in the Qumran Wisdom Texts," *JJS* 51 (2000): 141–44.
Müller, H.P. "Mantische Weisheit und Apokalyptik." Pages 268–93 in *Congress Volume Uppsala 1971*. VTSup 22. Leiden: Brill, 1972.
——. ed. *Babylonien und Israel: Historische, religiöse und sprachliche Beziehungen*. Darmstadt: Wissenschaftliche Buchgesellschaft, 1991.
Müller-Kessler, C. "Aramäische Beschwörungen und astronomische Omina in nachbabylonischer Zeit: Das Fortleben Mesopotamicher Kultur im vorderen Orient." Pages 427–41 in *Babylon: Focus Mesopotamischer Geschichte, Wiege früher Gelehrsamkeit, Mythos in der Moderne*. Edited by J. Regner. Saarbrücken: SDV Saarbrücker Druckerei und Verlag, 1999.
——. "Die aramäische Beschwörung und ihre Rezeption in den Mandäisch-magischen Texten: Am Beispiel Ausgewählter aramäischer Beschwörungsformulare." Pages 193–208 in *Charmes et sortilèges, magie et magiciens*. RO 14. Edited by R. Gyselen. Bures-sur-Yvette: Groupe pour l'Étude de la Civilisation du Moyen-Orient, 2002.
——. "The Mandeans and the Question of their Origin," *ARAM* 16 (2004): 47–60.
Murphy-O'Connor, J. "The Essenes and Their History," *RB* 81 (1974): 215–44.
Naeh, S. "Did the Tannaim Interpret the Script of the Torah Differently from the Authorized Reading?," *Tarbiz* 61 (1992): 401–48.
Nahman, D. "When Were the 'Daily Prayers' (4Q503) Said in Qumran?" *Shnaton* 13 (2002): 177–83 (Hebrew).
Nebe, G.W. "Qumranica II: Zu unveröffentlichten Handschriften aus Höhle 4 von Qumran," *ZAH* 10 (1997): 135–38.
Neugebauer, O. *Astronomical Cuneiform Texts: Babylonian Epheremedes of the Seleucid Period for the Motion of the Sun, the Moon, and the Planets*. London: Published for the Institute of Advanced Studies, Princeton, NJ by L. Humphries, 1955.
——. *A History of Ancient Mathematical Astronomy*. 3 vols. Berlin: Springer, 1975.
——. *Ethiopic Astronomy and Computus*. Österreichische Akedemie der Wissenschaften, philosophisch-historische Klasse, Sitzungsberichte 347. Vienna: ÖAW, 1979.
——. *Astronomy and History: Selected Essays*, NY: Springer, 1983.
——. "The 'Astronomical' Chapters of the Ethiopic Book of Enoch (72 to 82)." "Appendix A," pages 386–419, in M. Black, *The Book of Enoch or 1 Enoch*. SVTP 7. Leiden: Brill, 1985.
——. "A Babylonian Lunar Ephemeris from Roman Egypt." Pages 301–4 in *A Scientific Humanist: Studies in Memory of Abraham Sachs*. Edited by E. Leichty, Maria deJonge Ellis, and P. Gerardi. Philadalphia: Samuel Noah Kramer Fund, 1988.
Neugebauer, O. and A. Sachs. "The 'Dodekatemoria' in Babylonian Astrology," *AfO* 16 (1953): 65–66.
——. "Some Atypical Cuneiform Texts, II," *JCS* 22 (1968/1969): 92–113.

Neusner, J. *A History of the Jews in Babylonia. Vol. I – The Parthian Period*. Leiden: Brill, 1965.
Neusner, J. and A.J. Avery-Peck, eds. *George W.E. Nickelsburg in Perspective: An Ongoing Dialogue of Learning*. JSJSup 80. Leiden: Brill, 2003.
Nickelsburg, G.W.E. *1 Enoch 1*. Hermeneia. Minneapolis: Fortress, 2001.
Nickelsburg, G.W.E. and J.C. VanderKam, *1 Enoch: A New Translation*. Philadelphia: Fortress, 2004.
Nissen, H.J., P. Damerow, and R.K. Englund. *Archaic Bookkeeping: Early Writing and Techniques of Economic Administration in the Ancient Near East*. Trans. by P. Larsen. Chicago: Chicago University Press, 1993.
Nissen, H.J. and J. Renger, eds. *Mesopotamien und seine Nachbarn: Politische und kulturelle Wechselbeziehungen im alten Vorderasien vom 4. bis 1. Jahrtausend v. Chr*. Berlin: D. Reimer, 1987[2].
Nitzan, B. *Qumran Prayer and Religious Poetry*. STDJ 12. Leiden: Brill, 1994.
——. “The Idea of Creation and its Implications in Qumran Literature.” Pages 240–64 in *Creation in Jewish and Christian Tradition*. JSOTSup 319. Edited by H. Graf Reventlow and Y. Hoffman. Sheffield: Academic Press, 2002.
Oelsner, J. and W. Horowitz. “The 30-Star-Catalogue HS 1897 and the Late Parallel BM 55502,” *AfO* 44–45 (1997/98): 176–85.
Olson, D. *Enoch: A New Translation*. North Richland Hills, Texas: BIBAL, 2004.
Oppenheim, A.L. *Letters from Mesopotamia*. Chicago: University of Chicago Press, 1967.
——. “A Babylonian Diviner’s Manual,” *JNES* 33 (1974): 197–220.
Oppenheimer, A. *Between Rome and Babylon: Studies in Jewish Leadership and Society*. Edited by N. Oppenheimer. Tübingen: Mohr Siebeck, 2005.
Orlov, A.A. *The Enoch-Metatron Tradition*. TSAJ 107. Tübingen: Mohr Siebeck, 2005.
Osing, J. *Hieratische Papyri aus Tebtunis*. The Carlsberg Papyri 2. Copenhagen: Carsten Niebuhr Institute and Museum Tusculanum, 1998.
Otto, E. *Das Deuteronomium: Politische Theologie und Rechtsreform in Juda und Assyrien*. BZAW 284. Berlin: de Gruyter, 1999.
Parpola, S. *Letters from Assyrian Scholars to the Kings Esarhaddon and Assurbanipal. Part II: Commentary and Appendices*. AOAT 5/11. Kevalaer: Butzon and Bercker, 1983.
——. *Letters from Assyrian and Babylonian Scholars*. SAA 10. Helsinki: University of Helsinki Press, 1993.
——. “Mesopotamian Astrology and Astronomy as Domains of the Mesopotamian ‘Wisdom.’” Pages 47–59 in *Die Rolle der Astronomie in den Kulturen Mesopotamie: Beiträge zum 3. Grazer morgenländischen Symposion*. Edited by H.D. Galter. Graz: GrazKult, 1993.
Parpola, S., K. Radner, R. Mattila, R. Schmitt, and R. Zadok, eds. *The Prosopography of the Neo-Assyrian Empire*. 2 vols. Helsinki: University Press, 2001.
Parry, D.W. and E. Tov, eds. *The Dead Sea Scrolls Reader*. Leiden: Brill, 2004–2005.
Parry, D.W. and E. Ulrich, eds. *The Provo International Conference on the Dead Sea Scrolls*. STDJ 30. Leiden: Brill, 1999.
Paul, S.M. “The Mesopotamian Babylonian Background of Daniel 1–6.” Pages 55–68 in Vol. 1 of *The Book of Daniel: Composition and Reception*. 2 vols. VTSup 83. Edited by J.J. Collins and P. Flint. Leiden: Brill, 2001.
Payne-Smith, R. *Thesaurus Syriacum*. Oxford: Clarendon, 1879.
Perles, F. “Notes sur les Apocryphes et les Pseudépigraphes,” *REJ* 73 (1921): 173–85.
Pfann, S. “The Writings in Esoteric Script from Qumran.” Pages 177–90 in *The Dead Sea Scrolls Fifty Years After Their Discovery: Proceedings of the Jerusalem Conference, July 1977.* Edited by L.H. Schiffman, E. Tov, and J. VanderKam. Jerusalem: Israel Exploration Society, 2000.

Pinches. T.G. and J.N. Strassmaier, prepared for publication by A.J. Sachs with the co-operation of J. Schaumberger. *Late Babylonian Astronomical and Related Texts*. Providence: Brown University Press, 1955.

Pingree, D. "Mesopotamian Astronomy and Astral Omens in Other Civilizations." Pages 613–31 in *Mesopotamien und seine Nachbarn*. Edited by H.J. Nissen and J. Regner. Berlin: D. Reimer, 1987[2].

——. "MUL.APIN and Vedic Astronomy." Pages 439–45 in *DUMU-E$_2$-DUB-BA-A: Studies in Honor of Åke W. Sjöberg*. Occasional Publications of the Samuel Noah Kramer Fund 11. Edited by H. Behrens, D. Loding, and M.T. Roth. Philadelphia: University Museum, 1989.

——. "Legacies in Astronomy and Celestial Omens." Pages 125–37 in *The Legacy of Mesopotamia*. Edited by S. Dalley. Oxford: Oxford University Press, 1998.

Popović, M. "Physiognomic Knowledge in Qumran and Babylonia: Form, Interdisciplinarity, and Secrecy," *DSD* 13 (2006): 150–76.

——. *Reading the Human Body: Physiognomics and Astrology in the Dead Sea Scrolls and Hellenistic–Early Roman Period Judaism*. STDJ 67. Leiden: Brill, 2007.

Postgate, J.N. "Ḫarrān," *RlA* 4:122–25.

Powell, M.A. "Maase und Gewichte," *RlA* 7:467–68.

Qimron, E. *The Hebrew of the Dead Sea Scrolls*. HSS 29. Atlanta: Scholars Press, 1986.

Quack, J.F. "Les mages Égyptianisés: Remarks on Some Surprising Points in Supposedly Magusean Texts," *JNES* 65 (2006): 267–82.

Rau, E. "Kosmologie, Eschatologie und die Lehrautorität Henochs. Traditions- und formgeschichtliche Untersuchungen zum äthiopischen Henochbuch und zu verwandten Schriften." Dissertation, Hamburg, 1974.

Ravid, L. "The Relationship of the Sabbath Laws in *Jubilees* 50:6–13 to the Rest of the Book," *Tarbiz* 69 (2000): 161–66 (Hebrew).

——. "The Book of Jubilees and its Calendar – A Reexamination," *DSD* 10 (2003): 371–94.

Reeves, J.C. "Utanapishtim in the Book of Giants?," *JBL* 112 (1993): 110–15.

Reiner, E. "'*Lipšur*' Litanies," *JNES* 15 (1956): 129–49.

——. *Astral Magic in Babylonia*. TAPS 85, 4. Philadelphia: American Philosophical Society, 1995.

——. *Literary and Scholastic Texts of the First Millennium B.C.* CTMMA II. Edited by I. Spar and W.G. Lambert. NY: Metropolitan Museum of Art, 2005.

Reiner, E. in collaboration with D. Pingree. *Enūma Anu Enlil, Tablets 50–51*. BPO 2. Malibu: Undena, 1981.

Robbins, E. "The Pleiades, the Flood and the Jewish New Year." Pages 329–44 in *Ki Baruch Hu: Ancient Near Eastern, Biblical, and Judaic Studies in Honor of Baruch A. Levine*. Edited by R. Chazan, W.W. Hallo, and L.H. Schiffman. Winona Lake, Ind.: Eisenbrauns, 1999.

Rochberg, F. "Elements of the Babylonian Contribution to Hellenistic Astrology," *JAOS* 108 (1988): 51–62.

——. *Babylonian Horoscopes*. TAPS 88, 1. Philadelphia: American Philosophical Society, 1998.

——. "The Babylonian Origins of the Mandaean Book of the Zodiac," *ARAM* 11–12 (1999/2000): 237–47.

——. *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture*. Cambridge: Cambridge University Press, 2004.

Rochberg-Halton, F. "Canonicity in Cuneiform Texts," *JCS* 36 (1984): 127–44.

——. *Aspects of Babylonian Celestial Divination: The Lunar Eclipse Tables of Enūma Anu Enlil*. AfOBei 22. Horn: Berger, 1988.

——. "Babylonian Seasonal Hours," *Centaurus* 32 (1989): 146–70.

Sacchi, P. "The Two Calendars of the *Book of Astronomy*." Pages 128–39 in *Jewish Apocalyptic and Its History*. JSPSup 20. Trans. by W.J. Short. Sheffield: Academic Press, 1990.

Sachs, A. "A Classification of the Babylonian Astronomical Tablets of the Seleucid Period," *JCS* 2 (1948): 271–90.

——. "Babylonian Horoscopes," *JCS* 6 (1952): 49–75.

——. "Sirius Dates in Babylonian Astronomical Texts of the Seleucid Period," *JCS* 6 (1952): 105–14.

——. "The Latest Datable Cuneiform Texts." Pages 379–98 in *Kramer Anniversary Volume*. AOAT 25. Edited by B.L. Eichler, J. Heimerdinger, and A. Söjberg. Neukirchen-Vluyn: Neukirchener, 1976.

Samuel, A.E. *Greek and Roman Chronology: Calendars and Years in Classical Antiquity*. Handbuch der Altertumswissenschaft I, 7. Munich: C.H. Beck, 1972.

Sanders, S.L. "Old Light on Moses' Shining Face," *VT* 52 (2002): 400–6.

Sarna, N.M., ed. *Encyclopedia Miqra'it*. Jerusalem: Bialik Institute, 182. s.v. psalms, Book of," 8:437–62 (Hebrew).

Satlow, M. "4Q502 A New Year Festival?," *DSD* 5 (1998): 57–68.

Saulnier, S. "The Date of the Last Supper and Calendrical Variations in Second Temple Judaism." PhD Diss., University of Canterbury, 2006.

Schaffer, A. "The Mesopotamian Background of Lamentations (sic!), 4:9–12," *EI* 8 (1967): 246–50 (Hebrew).

——. "New Light on the 'Three-Ply Cord'," *EI* 9 (1969): 159–60 (Hebrew).

Schiffman, L.H. "Pre-Maccabean Halakhah in the Dead Sea Scrolls and the Biblical Tradition," *DSD* 13 (2006): 348–61.

Schiffman, L.H., E. Tov, and J.C. VanderKam, eds. *The Dead Sea Scrolls: Fifty Years After their Discovery 1947–1997. Proceedings of the Jerusalem Congress, July 20–25, 1997*. Jerusalem: Israel Exploration Society, 2000.

Schiffman, L.H. and J.C. VanderKam, eds. *Encyclopedia of the Dead Sea Scrolls*. Oxford: Oxford University Press, 2000.

Schmid, H.H. *Altorientalische Welt in der alttestamentlichen Theologie*. Zürich: Theologischer Verlag, 1974.

Schmidt, F. "Le calendrier liturgique des *Prières quotidiennes* (4Q503). En Annexe: L'apport du verso (4Q512) à l'edition de 4Q503." Pages 55–87 in *Le Temps et les Temps dans les littératures juives et chrétiennes au tournant de notre ère*. JSJSup112. Edited by C. Grappe and J.C. Ingelaere. Leiden: Brill, 2006.

Schniedewind, W.M. "Qumran Hebrew as an Antilanguage," *JBL* 118 (1999): 235–52.

Schwartz, M. "Qumran, Turfan, Arabaic Magic, and Noah's Name." Pages 231–38 in *Charmes et sortilèges magie et magiciens*. RO 14. Edited by R. Gyselen. Bures-sur-Yvette: Groupe pour l'Étude de la Civilisation du Moyen-Orient, 2002.

Schwarz, B.Y. "Šabūʿa, šabûʿôt and Seven Weeks," *Tarbiz* 65 (1996): 189–94 (Hebrew).

Seow, C.L. *Ecclesiastes*. AB. NY: Anchor Books, 1997.

Smith, M.S. "Biblical Narrative between Ugaritic and Akkadian Literature. Part II: Mesopotamian Impact on Biblical Narrative," *RB* 114.2 (2007): 189–207.

Snaith, N.H. *The Jewish New Year Festival: Its Origins and Development*. London: SPCK, 1947.

Soden, von W. *Akkadisches Handwörterbuch*. Wiesbaden: Harrassowitz, 1965–1981.

Sokoloff, M. *A Dictionary of Jewish Palestinian Aramaic*. Ramat Gan and Baltimore: Bar Ilan University Press and Johns Hopkins University Press, 2002.

Solomon, J. *Ptolemy Harmonics*: *Translation and Commentary*. Mnemosyne Supplement 203. Leiden: Brill, 2000.

Spalinger, A. "Some Remarks on the Epagomenal Days in Ancient Egypt," *JNES* 54 (1995): 33–47.

Steele, J.M. and A. Imhausen, eds. *Under One Sky: Astronomy and Mathematics in the Ancient Near East*. AOAT 297. Münster: Ugarit, 2002.
Stern, S. "Fictitious Calendars: Early Rabbinic Notions of Time, Astronomy and Reality," *JQR* 87 (1996): 103–29.
——. "Qumran Calendars: Theory and Practice." Pages 179–86 in *The Dead Sea Scrolls in their Historical Context*. Edited by T. Lim, L. Hurtado, G. Auld, and A. Jack. Edinburgh: T&T Clark, 2000.
——. *Calendar and Community: A History of the Jewish Calendar 2nd Century BCE – 10th Century CE*. Oxford: Oxford University Press, 2001.
Steymans, H.U. *Deuteronomium 28 und die adê zur Thronfolgeregelung Assarhdons: Segen und Fluch im alten Orient und in Israel*. OBO 145. Fribourg: Universitätsverlag, 1995.
Stone, M.E. "Apocryphal Notes and Readings," *IOS* 1 (1971): 123–31.
——. "Lists of Revealed Things in the Apocalyptic Literature." Pages 414–52 in *Magnalia Dei: Essays on the Bible and Archaeology in Memory of G. Ernest Wright*. Edited by F. M. Cross, W.E. Lemke, and P.D. Miller. NY: Doubleday, 1976.
——. "The Book of Enoch and Judaism in the Third Century B.C.E." *CBQ* 40 (1978): 479–92.
——. *Selected Studies in Pseudepigrapha and Apocrypha*. SVTP 9. Leiden: Brill, 1991.
Stuckenbruck, L.T. "Revision of the Aramaic-Greek and Greek-Aramaic Glossaries in *The Books of Enoch: Aramaic Fragments of Qumrân Cave 4* by J.T. Milik," *JJS* 41 (1990): 13–43.
——. *The Book of Giants from Qumran: Texts, Translation and Commentary*. TSAJ 63. Tübingen: Mohr Siebeck, 1997.
Swartz, M.D. "Ritual about Myth about Ritual: Towards an Understanding of the *Avodah* in the Rabbinic Period," *JJTP* 6 (1997): 135–55.
Swerdlow, N.M., ed. *Ancient Astronomy and Celestial Divination*. Cambridge, Mass./London: MIT Press, 1999.
Talmon, S. "Divergencies in Calendar-reckoning in Ephraim and Judah," *VT* 8 (1958): 48–74.
——. "The 'Manual of Benedictions' of the Sect of the Judaean Desert," *RQ* 2.4 (1960): 475–500.
——. "The Gezer Calendar and the Seasonal Cycle in Ancient Canaan," *JAOS* 83 (1963): 177–87.
——. *The World of Qumran from Within: Collected Studies*. Jerusalem and Leiden: Magnes/Brill, 1989.
——. "The Comparative Method in Biblical Interpretation: Principles and Problems." Repr. in *Literary Studies in the Hebrew Bible - Form and Content*. Jerusalem/Leiden: Magnes/Brill, 1993.
——. "The Covenanters' Calendar of Holy Seasons according to the List of King David's Compositions in the Psalms Scroll from Cave 11 (11QPs^{a} XXVII)." Pages 204–19 in *Fifty Years of Dead Sea Scrolls Research: Studies in Memory of Jacob Licht*. Edited by G. Grin and B. Nitzan. Jerusalem: Yad Ben Zvi, 2001, (Hebrew).
——. "Calendars and Mishmarot," *EDSS* 1:108–17.
Talmon, S. and I. Knohl. "A Calendrical Scroll from Qumran Cave IV – Miš Ba," *Tarbiz* 60.4 (1991): 505–21 (Hebrew). English translation: "A Calendrical Scroll from a Qumran Cave: *Mišmarot B^{a}*, 4Q321." Pages 261–301 in *Pomegranates and Golden Bells: Studies in Biblical, Jewish, and Near Eastern Ritual, Law, and Literature in Honor of Jacob Milgrom*. Edited by D.P. Wright, D.N. Freedman, and A. Hurvitz. Winona Lake, IN: Eisenbrauns, 1995.

Talshir, D. and Z. Talshir. “The Double Month Naming in Late Biblical Books: A New Clue for Dating Esther?,” *VT* 54 (2004): 549–55.
Temporini, H. and W. Haase. *Aufstieg und Niedergang der Römischen Welt*. Berlin: de Gruyter, 1972–1992.
Thiering, B. “The Qumran Sundial as an Odometer Using Fixed Lengths of Hours,” *DSD* 9 (2002): 347–63.
Tigchelaar, E.J.C. *To Increase Learning for the Understanding Ones: Reading and Reconstructing the Fragmentary Early Jewish Sapiential Text 4QInstruction*. STDJ 44. Leiden: Brill, 2001.
——. “Some Remarks on the Book of the Watchers, the Priests, Enoch and Genesis, and 4Q208,” *Henoch* 24 (2002): 143–45.
——. “Miniscula Qumranica I,” *RQ* 21.4 (2004): 643–48.
Toomer, G.J. “Hipparchus and Babylonian Astronomy.” Pages 353–62 in *A Scientific Humanist: Studies in Memory of Abraham Sachs*. Edited by E. Leichty, M. deJonge Ellis, and P. Gerardi. Philadelphia: The University Museum, 1988.
Toorn, van der, K. “Scholars at the Oriental Court: The Figure of Daniel Against Its Mesopotamian Background.” Pages 37–54 in Vol. 1 of *The Book of Daniel: Composition and Reception*. 2 vols. VTSup 83. Edited by J.J. Collins and P. Flint. Leiden: Brill, 2001.
Tov, E. “The Dimensions of the Qumran Scrolls,” *DSD* 5 (1998): 69–91.
——. “Further Evidence for the Existence of a Qumran Scribal School.” Pages 199–216 in *The Dead Sea Scrolls Fifty Years after their Discovery: Proceedings of the Jerusalem Congress, July 20-25, 1997*. Edited by L.H. Schiffman, E. Tov, and J. VanderKam. Jerusalem: Israel Exploration Society, 2000.
——. *Scribal Practices and Approaches Reflected in the Texts Found in the Judean Desert*. STDJ 54. Leiden: Brill, 2004.
Tubach, J. *Im Schatten des Sonnengottes: Des Sonnenkult in Edessa, Ḥarrān und Ḥaṭrā am Vorabend der christlichen Mission*. Wiesbaden: Harrassowitz, 1986.
——. “Spuren des astronomischen Henochbuches bei den Manichäern Mittelasiens.” Pages 73–89 in *Nubia et Oriens Christianus: Festschrift für C.D.G. Müller zum 60. Geburtstag*. Edited by P.O. Scholz and R. Stempel. Köln: Dinter, 1988.
——. “Synkellos’ Kalender der Hebräer,” *Vigilae Christianae* 47 (1993): 379–89.
——. “Der Kalender von *Baʿalbek*-Heliopolis,” *ZDPV* 110 (1994): 181–89.
Uehlinger, C. and S. Müller Trufaut. “Ezekiel 1, Babylonian Cosmological Scholarship and Iconography: Attempts at Further Refinement,” *Theologische Zeitschrift* 57 (2001): 140–71.
Uhlig, S. *Das äthiopische Henochbuch*. JSHRZ V, 6. Gütersloh: Gütersloher Verlag Gerd Mohn, 1984.
Ulrich, E. *The Dead Sea Scrolls and the Origins of the Bible*. Grand Rapids: Eerdmans, 1999.
Vanderhooft, D.S. *The Neo-Babylonian Empire and Babylon in the Latter Prophets*. HSMM 59. Atlanta: Scholars Press, 1999.
VanderKam, J.C. *Enoch and the Growth of an Apocalyptic Tradition*. CBQMS 16. Washington, DC: Catholic Biblical Association, 1984.
——. *The Book of Jubilees*. CSCO 510. Scriptores Aethiopici 87. 2 vols. Leuven: Peeters, 1989.
——. “Calendrical Texts and the Origins of the Dead Sea Scroll Community.” Pages 371–86 in *Methods of Investigation of the Dead Sea Scrolls and the Khirbet Qumran Site*. Edited by M.O. Wise, N. Golb, J.J. Collins, and D.G. Pardee. ANYAS 722. NY: New York Academy of Sciences, 1994.
——. “The Calendar, 4Q327, and 4Q394.” Pages 179–94 in *Legal Texts and Legal Issues: Proceedings of the Second Meeting of the International Organization for Qumran Studies, Cambridge 1995. Published in Honor of Joseph M.*

Baumgarten. STDJ 23. Edited by M. Bernstein, García Martínez, and J. Kampen. Leiden: Brill, 1997.
——. "Mantic Wisdom in the Dead Sea Scrolls," *DSD* 4 (1997): 336–53.
——. *Calendars in the Dead Sea Scrolls: Measuring Time*. London: Routledge, 1998.
——. "Studies on 'David's Compositions' (11QPs^{a} 27:2–11)," *EI* 26 (1999): 212–20.
——. *From Revelation to Canon: Studies in the Hebrew Bible and Second Temple Literature*. JSJSup 62. Leiden: Brill, 2000.
——. "Sabbatical Chronologies in the Dead Sea Scrolls and Related Literature." Pages 159–78 in *The Dead Sea Scrolls in their Historical Context*. Edited by T. Lim, L. Hurtado, G. Auld, and A. Jack. Edinburgh: T&T Clark, 2000.
——. "Scripture in the Astronomical Book of Enoch." Pages 89–103 in *Things Revealed: Studies in Early Jewish and Christian Literature in Honor of Michael E. Stone*. Edited by E. Chazon, D. Satran, and R. Clements. JSJSup 89. Leiden: Brill, 2004.
——. "1 Enoch 80 within the Book of the Luminaries." Pages 333–55 in *From 4QMMT to Resurrection: Mélanges qumraniens en homage à Émile Puech*. STDJ 61. Edited by F. García Martínez, A. Steudel and E. Tigchelaar. Leiden: Brill, 2006.
——. "Jubilees," *EDSS* 1:434–38.
Vantisphout, H.L.J. "*Enūma Eliš:* Tablet V Lines 15-22," *JCS* 33 (1981): 196–98.
Veenhof, K.R. "The Old Assyrian Hamuštum Period: A Seven-day Week," *JEOL* 34 (1995/1996): 5–26.
Verderame, L. *Le tavole I – VI delle serie astrologica Enūma Anu Enlil*. NISABA 2. Messina: Di.Sc.A.M., 2003.
Wacholder, B.Z. and M.G. Abegg. *A Preliminary Edition of the Unpublished Dead Sea Scrolls: The Hebrew and Aramaic Texts from Cave Four. Fascicle One*. Washington, D.C.: Biblical Archaeology Society, 1991.
Wacholder, B.Z. and S. Wacholder. "Patterns of Biblical Dates and Qumran's Calendar: The Fallacy of Jaubert's Hypothesis," *HUCA* 66 (1995): 1–40.
Wacholder, B.Z. and D.B. Weisberg. "Visibility of the New Moon in Cuneiform and Rabbinic Sources," *HUCA* 42 (1971): 227–42.
Waerden, van der, B.L. "Babylonian Astronomy. III. The Earliest Astronomical Computations," *JNES* 10 (1951): 20–34.
——. *Science Awakening II: The Birth of Astronomy*. Leiden:/NY: Noordhoff/Oxford University Press, 1974.
Weidner, E. "Babylonisches im Buche Enoch," *OLZ* 19 (1916): 74–75.
——. "Die astrologische Serie Enûma Anu Enlil," *AfO* 14 (1941–44): 172–95.
Weinfeld, M. *Deuteronomy and the Deuteronomic School*. Oxford: Clarendon, 1972.
——. *The Organizational Pattern and the Penal Code of the Qumran Sect*. NTOA 2. Fribourg: Editions universitaires, 1986.
Weitzman, S. "Why Did the Qumran Community Write in Hebrew?," *JAOS* 119 (1999): 35–45.
Werman, C. "The Flood Story in the Book of Jubilees," *Tarbiz* 64 (1995): 183–202 (Hebrew).
——. "Levi and Levites in the Second Temple Period," *DSD* 4 (1997): 211–25.
——. *Apocalyptic Literature of the Second Temple Period*. Tel Aviv: Ministry of Defense, 2003 (Hebrew).
——. "The Book of Jubilees and the Qumran Scrolls," *Meghillot* 2 (2004): 37–55 (Hebrew).
——. "Appointed Times of Atonement in the *Temple Scroll*," *Meghillot* 4 (2006): 107–15 (Hebrew).
——. "Epochs and End-time: The 490-year Scheme in Second Temple Literature," *DSD* 13 (2006): 229–55.
Westermann, C. *Genesis 1–11*. Trans. by J.J. Scullion. Minneapolis: Fortress, 1994.

Williams, C. “Signs from the Sky, Signs from the Earth: The Diviner’s Manual Revisited.” Pages 473–85 in *Under One Sky: Astronomy and Mathematics in the Ancient Near East*. AOAT 297. Edited by J.M. Steele and A. Imhausen. Münster: Ugarit, 2002.

Wise, M.O. “Second Thoughts on *dwq* and the Synchronistic Calendar.” Pages 98–120 in *Pursuing the Text: Studies in Honour of Ben Zion Wacholder on the Occasion of his Seventieth Birthday*. JSOTSup 184. Edited by J.C. Reeves and J. Kampen. Sheffield: Academic Press, 1994.

——. *Thunder in Gemini and Other Essays on the History, Language and Literature of Second Temple Palestine*. Sheffield: JSOT Press, 1994.

Wiseman, D.J. “A *lipšur* Litany from Nimrud,” *Iraq* 31 (1969): 175–83.

Wright, D.P. “The Laws of Hammurabi as a Source for the Covenant Collection (Exodus 20:23–23:19),” *Maarav* 10 (2003): 11–87.

Yadin, Y. *The Temple Scroll*. 3 vols. Jerusalem: Israel Exploration Society, 1985.

Yahalom, J. *Poetry and Society in Jewish Galilee of Late Antiquity*. Tel Aviv: Haqibutz haMeʾuhad, 1999 (Hebrew).

Yarbro-Collins, A. *Cosmology and Eschatology in Jewish and Christian Apocalypticism*. JSJSup 50. Leiden: Brill, 1996.

Yoshiko Reed, A. *Fallen Angels and the History of Judaism and Christianity: The Reception of Enochic Literature*. Cambridge: Cambridge University Press, 2005.

Zadok, R. *The Jews in Babylonia during the Chaldean and Achaemenian Periods According to the Babylonian Sources*. Haifa: University of Haifa, 1979.

——. *The Earliest Diaspora: Israelites and Judeans in Pre-Hellenistic Mesopotamia*. Tel Aviv: Diaspora Research Institute, Tel Aviv University, 2002.

Zatelli, I. “Astrology and the Worship of Stars in the Bible,” *ZAW* 103 (1991): 86–99.

Zisu, B. and A. Ganor. “Ḥorvat ʿEtri – The Ruins of a Second Temple Period Jewish Village on the Coastal Plain,” *Qadmoniot* 35.1 (2002): 18–27 (Hebrew).

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