CORPUS DES ASTRONOMES BYZANTINS
VII
publié par l'Institut Orientaliste de Louvain (Louvain-la-Neuve)

AN ALMANAC FOR TREBIZOND FOR THE YEAR 1336

by
RAYMOND MERCIER

Academia – 1994

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CORPUS DES ASTRONOMES BYZANTINS

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PREFACE

The knowledge of Islamic astronomy in the Byzantine world was more extensive than is generally realised. Few Byzantine astronomical texts have been published, in contrast to the much greater interest which has been generated by Greek astrology. The astronomy and astrology went hand in hand, so that it is unhistorical to study one to the exclusion of the other. However in the many astrological texts collected in the volumes of the CCAG there are few signs of technical and mathematical astronomy. The material examined in this monograph is a case in point, for it consists of an almanac for the year 1336-7, together with astrological predictions. The predictions have already been edited, and have been exploited by historians of Trebizond who find in them details which throw light on commerce and mores, while the almanac itself has been ignored. We shall see that a search for the sources of the almanac leads to a deeper appreciation of the transmission of mathematical astronomy from Persian sources to the Byzantine world.

It is a great pleasure to acknowledge here the patient and extensive support rendered to me by Anne Tihon throughout the preparation of this edition.

INTRODUCTION

INTRODUCTION

The common astronomical handbook of medieval astronomy, whether Greek, Islamic or Latin, provides the means of computing, through its extensive tabulation of mean longitudes and equations, the true positions of Sun, Moon and planets at any time. Less common are tabulations of the true positions themselves, but such works, which we would call almanacs[1] are also found within the medieval tradition.

The almanac which is the subject of this study is given on fols. 155v-171v. of the fourteenth century Greek Manuscript number 525 of the Bayerische Staatsbibliothek, in Munich[2]. It is untitled, and consists of monthly tables and short texts. The tables give the positions of Sun, Moon and planets in the course of the year 1336 Mar 12 to 1337 Mar 12, as well as listing for each day the length of the day, the time of the passage of the Moon through the signs, various configurations amongst the Sun, Moon and planets, and the phases of the planets. The work is prefaced by a *themation* for 1336 Mar 12, arranged in the conventional pattern, and the margins around the tables contain predictions for each of the ten-day periods of the year.

The astronomical contents of the almanac have not been studied hitherto, but the predictions have been edited for the CCAG (1908)[3], and again later by Lambros (1916), who made many valuable comments on this and other parts of the manuscript. The astrological predictions shed substantial light on life in the Empire of Trebizond at the time, as was discussed by Lambros. Karpov and Bryer have also consulted the predictions in their studies of mercantile and social life in Trebizond[4].

The greater part of this manuscript of 177 folios contains contains a number of works written in his own hand by Andreas Libadenus, a Byzantine official from Constantinople, who is thought to have been born in the early years of the century, and to have died soon after 1361. The most notable of these works (fols. 67^{r}-94^{v}) is the Περιηγητικῆς ἱστορίας ἀναβάσεως Ἀνδρέου, *History of Foreign Travel of Andreus*, written after 1349, and based on his visits to Egypt, the Holy Land, and eventually Trebizond, as under-secretary of a mission from Constantinople. The mission was originally established in order to resolve a dispute about the appointment of a Patriarch in Jerusalem[5].

A number of other works of Libadenus are also included in the volume, a list of which is given by him at the end[6]. In its present state, the volume includes only some of the listed works, and these not in the same order, so we can be

sure that some of the original folios have been lost, while the rest has been left in some disorder. There are as well some works not written by Libadenus, and of course not included in his list.

In this Almanac, neither the tables nor the accompanying predictions were written in Libadenus' hand, nor is it included in his list of his works, so that, as Lambros first realized, he was certainly not the author. The author is not known, but the question of authorship will be reviewed in the course of the commentary. Indeed it is even possible that the almanac and the predictions were by two distinct authors.

If Libadenus is not the author of the Almanac, there is nevertheless a clear indication, in the Περιήγησις, of his interest in astronomy. He writes for example[7],

'Αμέλει καὶ οὐκ ἀθεεῖ (P: εὐθέως) τὸ σκέμμα τοῦτο γενέσθαι μοι νενόμικα· ὑπένυττε γάρ με καὶ λόγος μάλα ξὺν ἄλλοις πολύς, ὡς ἐν Τραπεζοῦντι τῶν ἀστρονομικῶν μαθημάτων βελτίω χρῆσιν εὑρίσκεσθαι, οὐκ 'Αθήναζε, ἀλλὰ Χαλδίηθεν τῇ πόλει τῇδε περιϊοῦσαν τὴν μέθοδον, ἐφ' ᾧ καὶ τὴν τοσαύτην στέλλεσθαι πορείαν ἔρως ἡμᾶς ἀνέπειθε μάλιστα.

> To be sure, I did not immediately suppose that this project could be realized by myself. For I was struck above all by certain accounts, among many others, that at Trebizond one would find the best prediction based on astronomical sciences, coming not from Athens, but the method of Chaldaean origin which happened to come to this city; this reason especially persuaded us to undertake such a great voyage.

Lampsides[8], drew attention to this passage in order to explain Libadenus' voyage to Trebizond. However the above passage refers directly only to his interest in predictions of 'Chaldaean' type, not to astronomical methods or tables as such. Such predictions indeed accompany the Almanac, and it is of course reasonable to assume that the Almanac with its predictions are included in the manuscript of his works because of his interest.

We cannot be sure whether he added his own works to a manuscript in which the almanac had already been written or, perhaps more likely, had it copied by someone into his own manuscript; Lambros and Chrysanthus[9] make the point that one or the other must be the case. As the descriptions of the volume show, the leaves have at some time been disarranged, so that the present position of the almanac is not that which it originally occupied. As we shall see presently the

folios of the Almanac itself are somewhat disarranged.

The predictions are addressed to Constantine Loukites, as we see from the opening paragraph of the predictions (fol. 155^{r}),

> To begin with the aid of God, the year 6844 <A.D.1336>, while the Sun passed from Pisces to Aries, the 12th of the present month of March, feria 3 <Tuesday>, at the 4th hour of the day, Cancer being at the horoscope and 'lord of the house' of the Moon and Venus. Confident therefore in the unutterable patience of God and in his great mercy, we write in advance the events to come in the present year. It will therefore be good, and pleasing to God, for all Christians, and especially for our powerful and holy sovereign and King, with our very pious Lady, and the whole palace guarded by God, as well as for the army, and at the same time for the supreme archon of our powerful and holy Sovereign and King, the Grand Comnenus, and for the Protonotarius and Protovestiarius, Master Constantine Loukites: may the Lord keep them, he and them, and protect them, He the Creator of the years and who reigns for ever and ever, Amen.

Constantine Loukites was a very eminent official in Trebizond, honoured with the titles Protonotarios and Protovestiarios. He corresponded with Gregory Chioniades[10], who played the decisive role in the transmission of Persian astronomical handbooks to the Greek world, via Trebizond. It seems fair to conclude from the reports of such activity that Chioniades founded some form of school in Trebizond, and that the activity was patronised and supported by the Emperor and by Loukites[11]. Scholarly activity there was the attraction not only it seems for Libadenus, but also for Loukites, who arrived in the city after an education in Constantinople, and soon rose to great heights. It is not surprising perhaps to find that the predictions in the Almanac were dedicated to him, for he may have represented a source of patronage for this scientific activity. Papadopoulis tried to establish that an Academy of positive sciences had long existed in Trebizond[12], and that at the time of Chioniades the tower of the Church of the Hagia Sophia, 2 km to the West of Trebizond, had been used as an observatory. It is now known however that that tower was built only in 1426[13].

Nicephorus Gregoras of Constantinople, distinguished as a historian and scholar, corresponded with many of the leading figures of his time. In one his letters, to a certain George Pepagomenos[14], he refers to calculations of the positions of Sun, Moon and planets. He says,

> If you wish to know exactly the centres of the Sun, Moon and the five planets, listen. Note the difference which separates our predictions[15] from those which come to us from the Persians, and subject them so to speak to the test of time and experience. On Sept 23 next, of the 13th Indiction, at 6 hours after noon, Saturn will be found in the fifteenth degree of Leo, the Sun and the Moon, and the other four planets, each in the claws of Scorpio <ie Libra> - the Sun and the Moon in the 2nd degree, Jupiter and Mars in the 6th, Venus and Mercury in the 24th - then know that in the coming 13th Indiction, there will be two eclipses of the Moon and one of the Sun. That is, on Jan 5 <A.D.1330> in the evening, a little before midnight, there will be a lunar eclipse, a little less than 11 digits. Then six months later there will be a second lunar eclipse on June 30 at about 8 hours of the night. Finally on July 16, at about 11 hours of the day, there will be a total eclipse of the Sun.

Calculations from Ptolemy's Almagest or the Handy Tables yield the following values for the true longitudes, from which it is perfectly clear that Gregoras calculated from that work[16].

1329 Sept 23 (Sat) 6;0 p.m.

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY
Gregoras	182	182	135	196	196	204	204
Ptolemy	181;55	180;50	135; 5	195;39	195;57	204;43	203;52

Nicephorus Gregoras never entirely lost his faith in Ptolemy, although it would have been sorely tried if, as he recommended, he had compared these positions with observations. Tihon[17] in her study of his eclipse calculations draws attention to an apparent change in his feelings, when a few years later (1332) he writes to another correspondent, Michael Caloeides[18], of the need for corrections (διόρθωσις) to the tables (or *rules* ?: τῶν κανόνων), and laments the harm to his revered Ptolemy wrought by the "cruel tyrant Time". This is not to say that Gregoras knew then of the Persian astronomical tables, but it suggests a growing mood of doubt. Even so, the visits to Trebizond of Libadenus at least, and possibly also of Chrysococces seem to have been motivated by an interest in astrology rather than astronomical tables. There is no reason to believe that Persian astronomical tables were known in Constantinople before the Persian Syntaxis of *ca* 1346[19]. In any case Libadenus and Chrysococces would discover there the existence of the new tables, the latest products of astronomical

research from the Islamic culture area[20]. The numerical predictions from the Persian sources were substantially different from those of Ptolemy. For example, if the positions of the Sun, Moon and planets had been calculated for the above time from the Zīj-i Īlkhānī[21], we would have obtained the following results

1329 Sept 23 (Sat) 6;0 p.m.

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY
Zīj-i Īlkhānī	188;13	186;48	141; 5	200;22	201;45	197;44	209;48

These 'Persian' values are not only quite different from those of Ptolemy, but are in fact much nearer to the true positions.

These new tables were represented principally by the Zīj al-Sanjarī and the Zīj al-'Alā'ī, and later, the Zīj-i Īlkhānī, the last created at the observatory of Naṣīr al-Dīn al-Ṭūsī at Marāghah. All of these had been rendered into Greek, and were known in Trebizond by this time. We shall see that certainly the Zīj-i Īlkhānī, and possibly also the Zīj al-'Alā'ī, were used by the calculator of the Almanac for 1336.

DETAILED DESCRIPION OF THE COLUMNS OF THE TEXT

The manuscript is written on paper, 150 mm x 215 mm., fols. 177. In places it is quite illegible, where it is corroded and affected by dampness. It is formerly of the Library of Augsburg, as indicated by an *Ex Libris* in the cover.

Watermarks[22] are found on fols. 158, 161, etc. Among the examples given by Mošin the nearest is no.1993, date 1329; among those in Briquet, the nearest is no.3205, date 1334. Both dates are consistent with the composition of the Almanac on or about the year 1336 for which it was drawn up. It will be shown later however, that this is a copy of the Almanac, not that made by the original calculator.

On fol. 177, Libadenus has prefaced his list of his works as follows,

ἡ ἁγία τριὰς βοήθει μοι τῷ σῷ δούλῳ βροτῶν δὲ πάντων οἰκτίστῳ, πρωτοταβουλλαρίῳ καὶ χαρτοφύλακι τῆς Τραπεζουντίων ἁγιωτάτης μητροπόλεως καὶ ταῦτα γράφοντι σὺν τῇδε τῇ δέλτῳ Ἀνδρέᾳ Βυζαντιεῖ τῷ Λιβαδηνῷ καὶ οἱ τῇδε ἐντυγχάνοντες εὔχοισθε ἄν μοι σωτηρίας τυχεῖν ἀϊδίου Ἀμήν

Τὸ παρὸν πυξίον πάλαι μὲν ἐγράφην ἐμῇ σποράδην χειρί πλὴν ἀπερίττως οὕτως ὡς ἂν φαίη τις καὶ ἀκαλλῶς.[23]

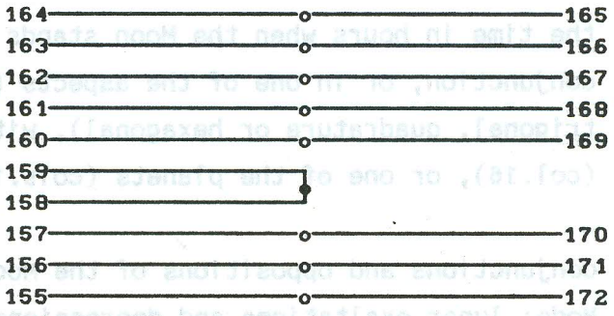
> May the Holy Trinity come to aid me your most pitiable slave, Prototaboullarios (Chief Registrar) and Chartophylax (Archivist) of the most holy city of Trebizond, and these writings together with this letter, Andrea Libadenus of Byzantium. And those coming upon this, may you entreat that I meet with eternal salvation. Amen.
>
> The present codex[24] was written in my hand here and there in the past, plainly, and some would say, unaffectedly.

The Almanac is on fols. 155-172, written in a poor hand, quite different from that found in the works written by Libadenus himself, in the rest of manuscript.

The folio now numbered 159 has been wrongly transferred from its place between 169 and 170. The contents, with the correct order of the folios, is as follows.

155 to 158v		Introduction and preliminary notes
160		Themation for 1336 Mar 12
160v	161	Month 1
161v	162	Month 2
162v	163	Month 3
163v	164	Month 4
164v	165	Month 5
165v	166	Month 6
166v	167	Month 7
167v	168	Month 8
168v	169	Month 9
169v	159	Month 10
159v	170	Month 11
170v	171	Month 12
171v	172	Month 13

The following diagram shows the foliation of the part of the MS containing the almanac. The faulty arrangement arises from the fact that the sheet marked 158-9 has been folded in error, so that the folio now marked 159 is no longer in its place between 169 and 170.



The margins to left and right of the monthly tables are filled with predictions, distributed according to the 'decans', that is 10-day intervals. These have been published in the CCAG, and by Lambros (1916). For convenience these 13 sections of the almanac will be referred to as 'months'. Each has 30 days, except the 13th which has 6 days. There are horizontal divisions, across the whole opening, into groups of 10 days each (decans), together with subdvisions, which group the days into pairs. In referring to positions in the Almanac, the month and day will be referred to by Roman and Indian numerals, so that for example, X,6 will mean the 6th day of the tenth month, which is the 276th day of the almanac. The 24 columns apparent in each opening are as follows; cols 1-13 on the left hand side, cols 14-23 on the right.

col.1 the names of the months in Greek and Hijra calendars, and also the names of some of the Sundays in the Greek Liturgical calendar. Various blank areas are filled with notes by a later hand;

cols.2-4 the weekday as a number, 1 to 7 (1 = Sunday), and monthly dates for the Hijra and Greek months;

cols.5-12 the positions (i.e., the true longitude) in degrees and minutes in each Zodiacal sign of the Sun, Moon, Saturn, Jupiter, Mars, Venus, Mercury, and the ascending node;

col.13 the length of day in hours and minutes;

col.14 the time in hours of the day, or the following night, when the Moon moved from one sign to the next;

col.15 the sign in which the Moon is situated at Noon;

cols.16-21 the time in hours when the Moon stands in conjunction, or in one of the aspects (diametral, trigonal, quadrature or hexagonal), with the Sun (col.16), or one of the planets (cols.17-21);

col.22 conjunctions and oppositions of the Moon and the Node; lunar exaltations and depressions;

col.23 exaltations and depressions of Sun or planets;
phases of each of the planets;
aspects amongst the Sun and the planets;
the entry of the planets into the signs;

SYMBOLS

Many symbols are used in the Almanac in addition to the familiar symbols of Sun, Moon and planets and the zodiacal signs. These symbols have been copied very much as they appear in the manuscript, and are as follows.

☌	σύνοδος	conjunction	
⚹	ἑξάγωνον	hexagonal aspect	
□	τετράγωνον	tetragonal aspect	
△, ▽	τρίγωνον	trigonal aspect	
☍	διάμετρον	opposition	
☊	rising node	☋	descending node
☊☋	nodes	κκ	καρόκερκος, 'head & tail'[25]
☾	δαίμονος	ϟ	zero
⊕	ψῆφος, position	⏑	ὥρα, length of day
♆	ὡροσκόπος	⫛	πρὸς
☉	day	☾	night

In order to avoid overcrowding of the printed page the phrase αἱ ἡμέραι and the names of months which appear at the heads of columns 2-4 have been placed among the footnotes.

NOTES TO THE INTRODUCTION

1. The term 'almanac' is used at the present time to refer to any tabulation of the true positions of Sun, Moon and planets over some period. The etymology of 'almanac' remains obscure in spite of extensive research and speculation. Certainly the word is most commonly found in Latin sources, but is known in Greek, Arabic and Hebrew; it may well have originated in Latin. Arabic sources more usually refer to taqwīm, and Greek sources to ἐφημερίς.
2. The fullest description of the manuscript is given by Lampsides (1968, 1975), which largely supercedes the earlier accounts of Lambros (1916) and Hardt (1812).
3. This volume of the CCAG was prepared by F.Boll, who may have edited this text.
4. Karpov (1986) 18 and *passim*; Bryer (1986b), (1986c). Karpov explains that a number a factors conspired to put Trebizond squarely on the East-West trade route passing through the Black Sea to the continent of Asia. These factors were the sack of Baghdad in 1258, the end of Crusader rule in Syria in 1291, and a Papal Interdict against Christian trade with Mameluk Egypt. The next stage in the route was Tabriz, in which a commercial quarter was established by the Ilkhanids; so close were trading relations from the late 13th century that a common system of weights and measures was to be found in the two capitals, as we know from Pegolotti's *La Pratica della Mercatura*, written in the mid 14th century, Pegolotti (1936).
5. The Περιήγησις was edited by Paranikas (1874), an edition which was reviewed in detail, with many new readings, by Lampsides (1968) 192-205, and re-edited by him, Lampsides (1975) 39-87.6.
6. This is given on f. 177^{r}; Lambros (1916) 34; Lampsides (1968) 175. Bryer (1986a) proposes Libadenus as the author of a poem - an 'epithalamy' - found in the MS Bodley Laud Gr.3, fol.158^{v}. In his long footnote 3, Bryer indulges in some speculation on the role of eclipses in Byzantine history, and on the present Almanac, which he calls a horoscope, and for which he wrongly proposes Chrysococces as the author.
7. Paranikas (1874) 22.13-19; Lampsides (1975) 59.33-60.5. In the first line P refers to the reading given by Paranikas. him, Lampsides (1975) 39-87. A summary of this biographical information and a basic bibliography are given in Trapp (1976), fasc. 7, No.14864.
8. Lampsides (1968) 233. Papadopoulos (1927) 154-5, also quoted the passage by way of confirming the existence of astronomical activity in Trebizond.
9. Lambros (1916) and Chrysanthus (1936), 341.
10. Letters from Chioniades are edited by Papadopoulos (1927), who identifies

certain ones as having been addressed to Loukites. According to Chrysanthus (1968), 339, he was a pupil of Chioniades, and not simply a colleague, but the evidence for this is not clear to me.

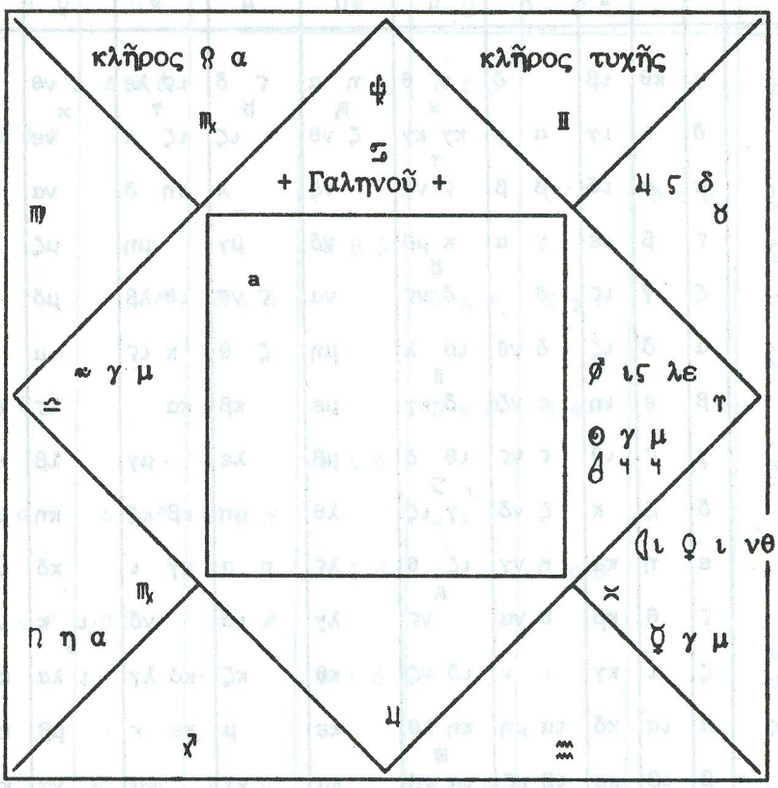
11. Papadopoulis (1927) 163, and Chrysanthus (1968) 339, view Chioniades as the scholar who conveyed the Persian material to Trebizond, and Loukites as the 'driving force'. See Mercier (1984) for references to studies of activity there; Bryer (1979), 292-3 has a brief remark on the school.
12. Papadopoulis (1919) 12, (1927) 155. Certainly he overstated this claim. Apart from the fourteenth century activity under discussion here, he referred to the period of study which Ananias of Shirak passed there in the early seventh century, as we learn from his autobiography: Berberian (1969), Lemerle (1969). Ananias is supposed to be the author of the fixed Armenian calendar.
13. Millet(1895) 431: the date A.M.6935 (A.D.1426/7) is inscribed at the bottom of the east face on the mortar, Ἔτους ,ϛλε′(ι)ν(δικτιῶνος) ε′ ἤρχθι. The only connection with astronomy seems to lie in the fact that Constantine Loukites is buried in the Church, if Mordtmann's record of a now lost epitaph is correct. Kirchhoff (1861) reports having found an epitaph which was read by Millet (1895) 433 as Κωνσταντίνου πέφυκα Λουκίτου τάφος. Bryer (1985) 234 comments, "The tower is a puzzling structure. Some maintain that it was the observatory of a local school of astronomers. Apart from the fact that this 'school' is notable for its failure to make any original astronomical observations (it failed to place Trebizond on Ptolemy's list and, apparently, to predict any of the eclipses which, according to Panaretos, took the Grand Komnenoi and their subjects so much by surprise), it flourished under Loukites over eighty years before the tower was built." The eclipse of 1336 is discussed further, sec.4.7. See also Bryer (1986a).
14. Guilland (1927) 72-83; this letter is partly cited in his History: van Dieten (1973) II,2, 233-6.
15. In fact he has in mind not predictions of the planetary positions, but the astrological predictions which would be made by others whom he views with contempt. The editor of the letters illustrates this by drawing attention to the predictions which accompany the Almanac which is here published; Guilland (1927), 72, n.2.
16. These values are found from Ptolemy's formulae directly, not from his tables. Tihon (1977), 153, has calculated these positions from the Handy Tables, getting essentially the same positions, apart from a slip which gave 207;52,11 for Mercury, instead of 204;52,11.
17. Tihon (1983) 21-2.
18. Guilland (1927) 155.

19. This in spite of the fact that examples in the Preface to the Zīj al-'Alā'ī are regularly constructed for Constantinople and the year A.D.1295-6; Pingree (1985), Part 1, *passim*.
20. Probably most of the astronomers were Muslim, but the patronage was by the Ilkhanid rulers who were certainly not Muslim.
21. The Zīj-i Īlkhānī is calculated for a meridian 12;0 West of its own standard meridian, through Marāghah, the shift which we find to be used in the case of the Almanac.
22. This consists of two circles of diameter 31 mm, their centres on a horizontal line. The horizontal line extends from the mid-point 53 mm to the left, 47 mm to the right.
23. Lampsides (1968) 175; Lampsides (1975), 21.
24. The word πυξίον is taken to be a variant of πυκτίον, listed by Liddell & Scott, who also have πυκτή, πυκτίς, 'codex', of which πυκτίον/πυξίον is a diminutive. Suidas lists πυξίς, defined as πινακίδιον, 'writing tablet'.
25. Refer to the discussion in Sec. 5.3.

EDITION

f. 160 r

THEMATION



ἐν τοῖς ϛωμδ

ἀράβων ψλζ

[a] + ἡ τῶν ὡρῶν τάξις αὕτη ἐστίν· ἐπιτολὴ Πλειάδων, ἀρχὴ θέρους ἐστίν· ἐπιτολὴ Κυνὸς τὸ δεύτερ(ον) τοῦ θέρους ἤτοι ἀρχὴ τῆς ὀπωρᾶς· Ἀρκτοῦρος ἐπιτέλλων, ἀρχὴ τοῦ φθινόντος ποιεῖται· εἶτα δύσις Πλειάδων ἀρχὴ χείμωνος γίνεται· ἡ μετὰ τὸν Χείμωνα ἰσημερία, τὴν ἀρχὴν ἔχει τοῦ ἔαρος:

+ τινές ἐφεῦρον καταρχὰς τῆς τέχνης· οὗτοι οἱ κατωτέρω:

f.160^{v}

MONTH 1

			a	☉	☽	☿	♀	♂	♃	♄	♅	♆
	γ	κθ	ιβ	δ	ι θ	η α	ς δ	ιϛ λε	ι νθ	γ μα	γ μ	ιβ α
	δ	λ	ιγ	α γ	κγ κγ	ζ νθ	ιζ	ιζ κ	νε	ε ι	λζ	δ
σαπάν	ε	α	ιδ	β β	ϛ νγ	νζ	λ	ιη δ	να	ϛ λζ	λδ	ζ
	ϛ	β	ιε	γ α	κ μδ	νδ	μγ	μη	μζ	η δ	λ	ι
	ζ	γ	ιϛ	δ	δ νϛ	να	ϛ νϛ	ιθ λβ	μδ	θ λα	κζ	ιγ
	α	δ	ιζ	δ νθ	ιθ λ	μη	ζ θ	κ ιϛ	μ	ι νζ	κδ	ιϛ
	β	ε	ιη	ε νζ	δ κγ	με	κβ	κα	λϛ	ιβ λζ	κα	ιθ
	γ	ϛ	ιθ	ϛ νϛ	ιθ δ	μβ	λε	μγ	λβ	ιδ ιζ	ιη	κα
	δ	ζ	κ	ζ νδ	γ ιζ	λθ	μη	κβ κζ	κη	ιε νζ	ιδ	κδ
	ε	η	κα	η νγ	ιζ θ	λϛ	η α	κγ ι	κδ	ιζ λζ	ια	κζ
	ϛ	θ	κβ	θ να	νϛ	λγ	ιδ	νδ	ι κ	ιθ ιη	η	λ
	ζ	ι	κγ	ι ν	ιδ νζ	κθ	κζ	κδ λγ	ι λα	κα ε	ε	λγ
ἡ βαϊηφόρος	α	ια	κδ	ια μη	κη λθ	κε	μ	κε κ	μβ	κβ νβ	γ β	λϛ
	β	ιβ	κε	ιβ μζ	ια νβ	κα	νγ	να	νγ	κδ λθ	β νη	λθ
	γ	ιγ	κϛ	ιγ με	κδ νθ	ιζ	θ ϛ	κϛ λ	ια δ	κϛ κϛ	νδ	μβ
	δ	ιδ	κζ	ιδ μδ	ζ λθ	ιγ	ιθ	κζ θ	ιε	κη ιγ	να	με
	ε	ιε	κη	ιε μγ	κ ιγ	θ	λβ	μη	κϛ	β	μη	μη
	ϛ	ιϛ	κθ	ιϛ μα	β μγ	ε	με	κη κζ	λζ	α να	με	να
νομικὸν φασχὰ	ζ	ιζ	λ	ιζ μ	ιδ νϛ	ζ α	νη	κθ ζ	μθ	γ μ	μβ	νδ
χρόνος πασχὰ	α	ιη	λα	ιη λθ	κϛ νθ	ϛ νζ	ι ια	κθ μζ	ιβ γ	ε κθ	λθ	ιβ νζ
ἀπρίλλιος	β	ιθ	α	ιθ λζ	η νε	νγ	κβ	κζ	ιβ	ζ ιζ	λζ	ιγ
	γ	κ	β	κ λε	κ μ	μθ	λϛ	μβ	μγ	θ η	λδ	β
	δ	κα	γ	κα λγ	β λη	μδ	ν	α κδ	ιγ ιδ	ι νθ	λ	ε
	ε	κβ	δ	κβ λβ	ιε θ	μ	ια δ	β ϛ	με	ιβ ν	κζ	ζ
	ϛ	κγ	ε	κγ λ	κζ νϛ	λε	ιη	μη	ιδ ιϛ	ιδ μβ	κδ	θ
	ζ	κδ	ϛ	κδ κη	ι μβ	λα	λβ	γ λ	μζ	ιϛ λδ	κα	ιβ
	α	κε	ζ	κε κζ	κγ ιε	κϛ	μϛ	δ ιγ	ιε ιη	ιη κϛ	ιη	ιδ
	β	κϛ	η	κϛ κε	ε νθ	κβ	ιβ	νϛ	μθ	κ θ	ιδ	ιζ
	γ	κζ	θ	κζ κγ	ιη νε	ιζ	ιδ	ε λϛ	ιϛ κ	κβ ιβ	ια	ιθ
	δ	κη	ι	κη κα	νϛ	ϛ ιβ	ιβ κη	ϛ κβ	ιϛ [1]	κδ ε	β η	ιγ κα

a μάρτιος
1 character lost with torn paper.

f.161 MONTH 1

ὁδὸς ☾	♓ ζῴδια	♂	♃	☿	♆	♀	♄	♇	
	♈		Δ β ὁ			ὃ ς ὁ			στηριγμός ♀
ε ῥ	♈	ὃ θ ῥ							
	♈							ὃ α ὁ	♄ Δ τὸν ♃
θ ῥ	♈				ὃ β ὁ				♄ ΧΧ τὸν ☿
	♉		– ϟ ῥ	ὃ ι ὁ		ΧΧ ε ῥ	ΧΧ γ ῥ		♂ εἰς τὸν ☉
θ ῥ	♉								♄ ὃ τὴν ♀
	♊	ΧΧ θ ὁ				□ ε ῥ	□ θ ῥ		
	♊				ΧΧ ι ὁ				ταπείνωμα ♄
ϟ ὁ	♋	□ α ῥ	Δ β ῥ	ΧΧ β ῥ		Δ ι ῥ			
	♋				□ ζ ῥ		Δ ς ὁ		
ς ὁ	♌	Δ ι ῥ	□ ι ῥ	□ ι ῥ					
	♌				Δ ϟ ὁ				προποδισμός ☿ – τὸν ♃
ι ὁ	♌								
	♍		ΧΧ ϟ ὁ	Δ ϟ ὁ		– η ὁ			♀ ΧΧ τὸν ☿
γ ῥ	♍						– η ὁ	– δ ῥ	δύνη ὁ ♂
	♎	– η ῥ							
	♎				– ζ ῥ			κκ ς ὁ	♄ εἰς τὸν ☽
α ὁ	♏		ὃ β ῥ			Δ ια ῥ		τα^{2}ζ ὁ	♄ εἰς τὸν ☉
	♏			– ϟ ὁ					
ιβ ὁ	♏								ὕψωμα ♂
	♐					□ α ῥ	Δ γ ὁ		♂ εἰς τὸν ☽
	♐	Δ ς ὁ							
α ὁ	♑		ΧΧ η ῥ	Δ ι ῥ	Δ ε ὁ				
	♑	□ η ῥ				ΧΧ β ὁ	□ α ὁ		
ι ὁ	♑		□ ι ῥ		□ γ ῥ				
	♒			□ θ ὁ			Δ ε ῥ		
ς ῥ	♒	ΧΧ ια ὁ							
	♓		Δ ζ ὁ	ΧΧ γ ῥ[1]	ΧΧ γ ὁ				
	♓					ὃ α ὁ			
ς ὁ	♈							ὃ ι ὁ	♂ – τὸν ♃

1 faint, ῥ inferred
2 in this column τα^{πν} written always for ταπεινώμα

f.161v

MONTH 2

a	b	c	Ϙ Ϛ	Ϙ Ϟ	Ϙ Ϡ	Ϙ Ϣ	Ϙ Ϥ	Ϙ Ϧ	Ϙ Ϩ	Ϙ Ϫ	αἱ ϕ
	ε	κθ	ια	κη ις	ιε μη	ς ζ	ιβ μα	ζ λβ	ιζ κε	κε νζ	β ε	ιγ κγ
	ς	λ	ιβ	κθ ιγ	κθ νς	ς α	νς	η κβ	ιη ιβ	κζ νβ	β β	κε
ῥαμαδὰν	ζ	α	ιγ	ι	ιγ ν	ε νς	ιγ ιβ	θ ιβ	νθ	κθ μζ	α νθ	κη
	α	β	ιδ	α η	κη ιδ	να	κη	ι β	ιθ μς	α μβ	νε	λ
	β	γ	ιε	β ε	ιβ ν	μς	μδ	νβ	κ λγ	γ λζ	νβ	λγ
	γ	δ	ις	γ β	κζ νζ	μα	ιδ	ια μβ	κα κ	ε λ	μθ	λε
	δ	ε	ιζ	δ	ιβ μη	λς	ις	ιβ λβ	κβ ζ	ζ κγ	μς	λη
	ε	ς	ιη	δ νζ	κζ λε	λα	λβ	ιγ κβ	νδ	θ ις	μγ	μ
	ς	ζ	ιθ	ς νδ	ια μζ	κς	μη	ιδ ιβ	κγ μα	ια θ	λθ	μγ
	ζ	η	κ	ζ νβ	κδ κς	κα	νδ	ιε β	κδ κη	ιγ β	λς	με
	α	θ	κα	η μθ	ζ μη	ις	ιε	να	κε ιβ	ιδ νδ	λγ	μη
	β	ι	κβ	θ μς	κα λε	ιβ	ιδ	ις λα	κς β	ις με	λ	ν
	γ	ια	κγ	ι μγ	δ κβ	ζ	κη	ιζ ιβ	νβ	ιη λς	κζ	νγ
	δ	ιβ	κδ	ια μα	ις νβ	ε γ	μβ	νγ	κζ μβ	κ κζ	κγ	νε
	ε	ιγ	κε	ιβ λη	κθ ιδ	δ νη	νς	ιη λδ	κη λβ	κβ ιη	κ	νη
	ς	ιδ	κς	ιγ λε	ια κδ	νδ	ις ι	ιθ ιε	κθ κβ	κδ θ	ιζ	ιδ
	ζ	ιε	κζ	ιδ λβ	κγ κγ	μθ	κδ	νς	ιβ	κς	ιδ	β
	α	ις	κη	ιε λ	ε κε	με	λη	κ λζ	α β	κζ να	ια	δ
	β	ιζ	κθ	ιε κζ	ιζ κβ	μ	νβ	κα ιη	νγ	κθ μα	η	ζ
	γ	ιη	λ	ις κδ	κθ ιε	λς	ιζ ς	νθ	β μγ	α λα	ε	ι
μάϊος	δ	ιθ	α	ιζ κα	ι νζ	λα	κ	κβ μβ	γ λδ	γ κα	α β	ιβ
	ε	κ	β	ιη ιθ	κβ λη	κε	λδ	κγ κε	δ λ	ε γ	ϛ νη	ιδ
	ς	κα	γ	ιθ ις	δ λδ	κ	μη	κδ η	ε κς	ς με	νε	ιζ
	ζ	κβ	δ	κ ιγ	ις η	ιε	ιη β	να	ς κβ	η κζ	νβ	ιθ
	α	κγ	ε	κα ι	κη νη	ι	ις	κε λδ	ζ ιη	ι θ	μθ	κα
	β	κδ	ς	κβ ζ	ιβ γ	ε	λα	κς ιζ	η ιδ	ια μθ	μς	κγ
	γ	κε	ζ	κγ δ	κε ιζ	δ	μς	κζ	θ ι	ιγ κδ	μβ	κε
	δ	κς	η	κδ α	η μη	γ νε	ιθ α	μγ	ι ς	ιδ νη	λθ	κζ
	ε	κζ	θ	κδ νθ	κδ μγ	ν	ις	κη κς	ια	ις λβ	λγ	κθ
	ς	κη	ι	κε νς	ς νβ	γ με	ιθ λ	κθ θ	ια νγ	ιη ς	ϛ λγ	ιδ λ

a αἱ ἡμέραι b σαπάν c ἀπρίλλιος

f.162 MONTH 2

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ ☊	♓ τὸν ♃	♓ ♅	♓ ☋	♓ τοὺς ☿	
	♈							
ζ ὁ	♈	♁ ζ ὁ	− ζ ☌		♁ ζ ☌	♁ γ ὁ	ὕψωμα ♋ ☌	
	♉			♁ ζ ὁ		XX ε ☌		☋ εἰς τὸν ♉
θ ὁ	♉							καῦμα ☋
	♊					□ ι ☌		ἔδυνε ♃
ι ὁ	♊	XX η ☌	▽²ι ☌			XX η ☌		☋ ≈ ☊
	♋			XX ια ὁ	XX ζ ὁ	△ ια ☌		♂ ≈ ☊
ια ὁ	♋	□ ζ ☌	□ ε ☌					
	♌			□ ιγ ὁ	□ ιγ ὁ		□ ζ ὁ		♅ ♁ ♃
β ☌	♌¹							
	♍	△ γ ὁ	XX³β ὁ	△ η ☌	△ θ ☌		△ ζ ☌		☋ ♁ ♃
δ ☌	♍					− δ ☌			☋ ♁ ♅
	♎							− α ὁ	ὕψωμα ♋
	♎							κκ ιβ ὁ	
θ ὁ	♎		♁ ς ☌					τα ιβ ὁ	
	♏	− ιβ ὁ		− γ ☌					♋ εἰς τὸν ♈
ζ ☌	♏				− α ὁ	△ θ ☌	− ιγ ὁ		καῦμα ♃
	♐								♋ εἰς τὸν ♑
	♐								☋ εἰς τοὺς ♊
θ ὁ	♐		XX ς ☌			□ ϛ ☌			
	♑	△ θ ☌		△ η ☌					☋ XX ♋
θ ☌	♑				△⁴θ ὁ				φάνει ☋ δυτικά
	♒		□ ζ ὁ			XX θ ὁ	△ ια ὁ		
	♒	□ γ ☌		□ ια ὁ					
ι ὁ	♒		△ γ ☌		□ ϛ ὁ				
	♓			XX ς ☌			□ ζ ὁ		
γ ☌	♓	XX γ ὁ			XX ια ὁ			♁ ε ☌	
	♈					♁ θ ὁ	XX η ☌		
ζ ☌	♈								
	♉		³ι ὁ					ὕψωμα α ὁ	

1 the symbol for Leo is rotated 180° in MS.
2 ▽ superimposed on XX.
3 △ superimposed on XX.
4 △ superimposed on −.

f.162ᵛ

MONTH 3

		a	b	♑	♒	♓	♈	♉	♊	♋	♌	αἰ ♍
	ζ	κθ	ια	κη ις	κγ ιη	γ μ	ιθ μς	κθ να	ιβ νζ	ιθ μα	κθ	ιδ λγ
σαουάλ	α	α	ιβ	κθ ιγ	ζ νθ	λς	κ α	λγ	ιγ νβ	κα ε	κς	λδ
	β	β	ιγ	ϛ ι	κβ να	λβ	ιε	α ιε	ιδ μζ	κβ κθ	κγ	λς
	γ	γ	ιδ	α η	ζ λς	κη	κθ	νζ	ιε μβ	κγ νγ	ιθ	λζ
	δ	δ	ιε	β ε	κβ κς	κδ	μγ	β λθ	ις λζ	κε ιζ	ις	λθ
	ε	ε	ις	γ β	ζ ιβ	κ	κ νζ	γ κα	ιζ λβ	κς λθ	ιγ	μ
	ς	ς	ιζ	δ	κα λα	ις	κα ια	δ γ	ιη κζ	κζ μς	ι	μβ
	ζ	ζ	ιη	δ νζ	ε ιη	ιβ	κε	με	ιθ κβ	κη νγ	ζ	μγ
	α	η	ιθ	ε νδ	ιη με	η	λθ	ε κζ	κ ιζ	ϛ	γ	με
	β	θ	κ	ς νβ	α μθ	ε	κα νγ	ς θ	κα ιγ	α η	ϟ ϟ	μς
	γ	ι	κα	ζ μθ	ιδ λδ	γ β	κβ ζ	ς μθ	κβ θ	β ις	κθ νζ	μη
	δ	ια	κβ	η μς	κζ γ	β νη	κα	ζ λα	κγ ιζ	γ β	νδ	μθ
	ε	ιβ	κγ	θ μγ	θ ις	νε	λε	η ιγ	κδ κε	μζ	να	να
	ς	ιγ	κδ	ι μη	κα κβ	να	μθ	νε	κε λγ	δ λβ	μζ	να
	ζ	ιδ	κε	ια λη	β λς	μη	κγ γ	θ λζ	κς μα	ε ιζ	μδ	νβ
	α	ιε	κς	ιβ λε	ιδ ιγ	μδ	ις	ι ιθ	κζ μθ	ε νθ	μα	νγ
	β	ις	κζ	ιγ λβ	κς ς	μ	κθ	ια	κη νζ	ς ιβ	λη	νδ
	γ	ιζ	κη	ιδ λ	η ιη	λς	μβ	μα	ε	κε	λε	νε
	δ	ιη	κθ	ιε κζ	κ δ	λβ	κγ νε	ιβ κβ	α ιγ	λη	λβ	νς
	ε	ιθ	λ	ις κζ	α μη	κη	κδ η	ιγ γ	β κα	ς ν	κθ	νζ
	ς	κ	λα	ιζ κα	ιγ με	β κε	κδ κα	ιγ μδ	γ κη	ζ γ	κς	νη
ἰούνιος	ζ	κα	α	ιη ιθ	κς γ	κβ	λδ	ιδ κε	δ λδ	ς λδ	κβ	νθ
	α	κβ	β	ιθ ις	η με	ιθ	μη	ιε ς	ε μ	ε	ιθ	ιδ νθ
	β	κγ	γ	κ ιγ	κα μα	ις	κε α	μζ	ς μς	ε λς	ις	ιε
	γ	κδ	δ	κα ι	δ νθ	ιγ	ιε	ις κζ	ζ νβ	ζ	ιγ	α
	δ	κε	ε	κβ ζ	ιη κς	θ	κη	ιζ ζ	η νη	δ λς	ι	β
	ε	κς	ς	κγ δ	β λθ	ς	μβ	μζ	ι δ	γ μα	ς	
	ς	κζ	ζ	κδ α	ιζ ιη	γ	νε	ιη κζ	ια ι	β μς	γ	γ
	ζ	κη	η	κδ νθ	α μθ	β	κς θ	ιθ ζ	ιβ ις	α να	κθ	δ
	α	κθ	θ	κε νς	ις νς	α νζ	κς κδ	ιθ μζ	ιγ κβ[1]	ϟ νς	κη νζ	δ

a ῥαμαδὰν; μάϊος also written in error b μάϊος

1 paper lost, κ inferred.

f.163 MONTH 3

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♃	♓ τὸν ♄	♓ ☉	♓ τὸν ♀	♓ τὸν ☿	♓ τοὺς ☊	
ζ ρ	♉	♂ β ρ		♂ α ♉	♂ ζ ρ				
	♊					♋ ζ ρ			☉ ♊
η ρ	♊						♂ ζ ♉		
	♋		♎ α ♉			♌ η ρ			
η ρ	♋	♋ ζ ρ		♋ β ♉	♋ θ ρ				
	♌	♋ ч ♉	♌ α ♉						καῦμα ☉
θ ρ	♌			♌[1]ζ ♉		♎ α ♉	♎ ε ρ		
	♍	♌ η ♉	♎ γ ♉		♌ ζ ♉				
	♍			♎[2]ιγ ♉					☿ ♋
δ ♉	♎	♎ ε ρ			♎ γ ρ		♌ ζ ♉	− γ ♉	
	♎					− η ρ		κκ η ρ	
ч ρ	♎		♂ ζ ρ				♎ δ ρ	τα η ρ	☿ ♎ ♊
	♏								
	♏			− ιβ ♉					
γ ♉	♐				− ε ρ				
	♐	− δ ♉							φαίνεται ♃
α ρ	♐		♎ ς ρ			♎ ιγ ♉			
	♑						− γ ♉		☋ ♂
	♑			♎ α ρ					
δ ♉	♒		♌ θ ♉			♌ δ ♉			☋ ≏ ♊
	♒	♎ α ρ			♎ η ♉				ἀναποδισμός ☿
α ρ	♒		♎ δ ρ	♌ γ ♉					
	♓				♌ ζ ρ	♋ ч ♉	♎ α ♉		☿ ♋ ☋
η ρ	♓	♌ ε ♉		♋ α ρ				− ζ ρ	
	♈						♌ η ♉		
	♈	♋ β ρ			♋ ε ♉				δύν(ει) ☿ δυτικὰ
β ♉	♉		− ς ♉			♉ η ρ	♋ θ ♉	ὕψωμα ε ♉	
	♉			♉ η ρ					☿ ♎ ♊
δ ♉	♊								
	♊				♉ α ρ				

1 MS has ☒.
2 ♎ superimposed on ☐.

f.163^{v}

MONTH 4

	a	b	c	Ϙ δ	Ϙ ζ	Ϙ η	Ϙ μ	Ϙ ϕ	Ϙ ϙ	Ϙ ϡ	Ϙ θ	αἱ ὧραι
	β	α	ι	κς νδ	α μδ	α νγ	κς λζ	κ κζ	ιδ κζ	ϛ	κη νδ	ιε ε
	γ	β	ια	κζ να	ιε να	να	ν	κα η	ιε λβ	κθ α	να	
	δ	γ	ιβ	κη μη	λβ	μθ	κζ γ	μθ	ιϛ λζ	κη γ	μη	
	ε	δ	ιγ	κθ με	ιε ζ	μζ	ιϛ	κβ λ	ιζ μβ	κζ δ	μδ	ε
	ϛ	ε	ιδ	μγ	κθ λθ	με	κθ	κγ ια	ιη μζ	κϛ ε	μα	δ
	ζ	ϛ	ιε	α μ	ιγ μθ	μγ	μβ	νβ	ιθ νγ	κε ϛ	λη	
	α	ζ	ιϛ	β λβ	κζ[1] λε[1]	μβ	νε	κδ λγ	κ νθ	κδ λ	λε	δ
	β	η	ιζ	γ[1] λδ[1]	ζ νδ[1]	μα	κη η	κε ιδ	κβ ε	κγ κδ	λβ	γ
	γ	θ	ιη	δ λα	κγ μδ	μ	κα	νδ	κγ ια	μη	κη	
	δ	ι	ιθ	ε κη	ϛ. ι	λθ	λδ	κϛ λδ	κδ ιζ	κβ κδ	κε	γ
	ε	ια	κ	ϛ κε	ιη κ	λη	κη μζ	μζ ιδ	κε κγ	κβ ε	κβ	β
	ϛ	ιβ	κα	ζ κγ	ιϛ	λζ	κθ	νδ	κϛ λβ	ια	ιθ	
	ζ	ιγ	κβ	η κ	ιβ δ	λϛ	ιγ	κη λδ	κζ μα	ιζ	ιϛ	α
	α	ιδ	κγ	θ ιζ	κγ νδ	λε	κε	κθ ιδ	κη ν	κγ	ιβ	ιε
	β	ιε	κδ	ι ιδ	ε κϛ	λδ	λζ	νδ	κθ νθ	κθ	θ	ιδ νθ
	γ	ιϛ	κε	ια ια	ιζ μδ	λγ	κθ μθ	λδ	α η	κβ λϛ	ϛ	νη
	δ	ιζ	κϛ	ιβ θ	κθ μδ	λβ	α	α ιδ	β ιζ	κγ ιδ	γ	
	ε	ιη	κζ	ιγ ϛ	ι νη	λα	ϟ ιγ	νγ	γ κϛ	νβ	κη	νζ
	ϛ	ιθ	κη	ιδ γ	κγ κϛ	λ	κε	β λβ	δ λε	κδ λ	κζ νζ	νϛ
	ζ	κ	κθ	ιε	ε κη	κθ	λζ	γ ια	ε μδ	κε η	νδ	νε
	α	κα	λ	ιε νζ	ιζ λδ	α κθ	ϟ μθ	γ ν	ϛ νγ	κε με	να	
ἰούλλιος	β	κβ	α	ιϛ νδ	κϛ		α	δ κθ	η β	κϛ μθ	μζ	νδ
	γ	κγ	β	ιζ να	ιγ λ		ιβ	ε η	θ ι	κζ νγ	μδ	νγ
	δ	κδ	γ	ιη μη	κϛ νθ		κδ	μζ	ι ιη	κη νζ	μα	νβ
	ε	κε	δ	ιθ με	θ ν		λϛ	ϛ μϛ	ια κϛ	ϛ α	λη	να
	ϛ	κϛ	ε	κ μβ	κε ι		μη	ζ ε	ιβ λδ	α ϛ	λε	μθ
	ζ	κζ	ϛ	κα λθ	ι		α νθ	μδ	ιγ μβ	β ιϛ	λα	μη[2]
	α	κη	ζ	κβ λϛ	κδ ν		β ι	η κγ	ιδ ν	γ κϛ	κη	μζ
	β	κθ	η	κγ λδ	θ μζ		κα	θ β	ιϛ β	δ λϛ	κε	μϛ
	γ	α	θ	κδ λα	κδ μγ	α κθ	β νβ	θ μα	ιζ ι	ϛ μϛ	κζ κα	ιδ μδ

a αἱ ἡμέραι b δελχάτε c ἰούνιος

1 ζ, ε, γ, δ, δ all written over other characters.

2 MS ∎, η inferred.

f.164 MONTH 4

ὁδὸς ☾	ζῴδια	♂ τὸν ♂	♂ τὸν ☊	♂ τὸν ♃	♂ τὸν ☿	♂ τὸν ♀	♂ τὸν ☽	♂ τοὺς ☓	
δ ὁ	♋	ὃ ϟ ὁ	Δ ζ ὁ				ὃ θ ὁ		
	♋			ΧΧ θ ℞		ΧΧ ζ ὁ			☿ εἰς τοὺς ☊
ζ ὁ	♌		□ θ ὁ						καῦμα ☿
	♌				ΧΧ ζ ℞	□ ι ὁ			
η ὁ	♌	ΧΧ θ ὁ	ΧΧ ια ὁ	□ γ ὁ			ΧΧ α ὁ		
	♍					Δ γ ℞			♂ Δ ☊
α ℞	♍	□ ε ℞	[1]	Δ η ὁ	□ α ὁ		□ β ὁ	– θ ὁ	☿ ὃ ♂
	♎								
ζ ℞	♎		ὃ ζ ℞		Δ ζ ὁ		Δ η ὁ	κκ α ὁ	
	♏	Δ ε ὁ						τα α ὁ	
	♏					– ς ℞			προποδισμός ☿
ζ ὁ	♐			– ε ὁ					φαίνεται ☿ εἰς ἀνατολήν
	♐								
η ℞	♐		ΧΧ η ℞		– ε ℞		– δ ὁ		☿ ὃ ♃
	♑	– β ℞							☿ ☊
	♑							♂ ♋	♃ εἰς τοὺς ☊
η ὁ	♑		□ ι ὁ	Δ θ ὁ					♂ Δ ☊
	♒								
ζ ℞	♒			□ ς ℞		Δ θ ὁ	Δ θ ὁ		
	♓		Δ ϟ ὁ		Δ ε ὁ				
	♓	Δ β ὁ				□ η ℞	□ ζ ℞	ὃ θ ℞	στηρίζει ♃
ε ὁ	♈			ΧΧ ς[2] ὁ	□ ζ ℞				
	♈	□ ιγ ὁ							
α ℞	♈		– β ℞			ΧΧ ια ὁ	ΧΧ ι ὁ	ὕψωμα ε ℞	☿ ♋
	♉	ΧΧ η ℞			ΧΧ α ὁ				
ε ℞	♉			ὃ ε ℞					☿ Δ ☊
	♊								φαίνεται ♂
ς ℞	♊		Δ ς ℞				ὃ η ℞		
	♋				ὃ ζ ὁ	ὃ α ὁ			
ζ ℞	♋	ὃ ζ ὁ	□ ς ℞	ΧΧ η ℞					

1 □ ε ℞ erased, remains faintly legible.
2 θ superimposed on ς.

f.164^{v}

MONTH 5

	a	b	c	☽	☽	♃	♄	☉	☿	♀	♂	αἱ ☾
	δ	α	ι	κε κθ	θ μα	α λ	β μδ	ι κβ	ιη ιδ	ζ νγ	κζ ιη	ιδ μγ
	ε	β	ια	κς κζ	κγ νε	λα	β νδ	νγ[1]	ιθ κη	θ κδ	ιε[2]	μα
	ς	γ	ιβ	κζ κδ	ζ νς	λβ	γ ε	ια λβ	κ μβ	ι νς	ιβ	μ
	ζ	δ	ιγ	κη κβ	κα μζ	λγ	ιε	ιβ ια	κα νς	ιβ κη	η	λη
	α	ε	ιδ	κθ κ	ε κβ	λδ	κς	ν	κγ ι	ιδ	ε	λζ
	β	ς	ιε	ιζ	ιη λε	λε	λς	ιγ κθ	κδ κδ	ιε λβ	κζ β	λε
	γ	ζ	ις	α ιε	α λγ	λς	μζ	ιδ η	κε λη	ιζ ιδ	κς νθ	λγ
	δ	η	ιζ	β ιβ	ιδ λη	λζ	γ νζ	μζ	κς νβ	ιη νς	νς	λα
	ε	θ	ιη	γ ι	κζ λ	λη	δ η	ιε κγ	κη ς	κ λη	νβ	κθ
	ς	ι	ιθ	δ ζ	ι	μ	ιη	ις γ	κθ κ	κβ κ	μθ	κζ
	ζ	ια	κ	ε ε	κα νς	μγ	δ κθ	ις μθ	κε	κδ	μς	κε
	α	ιβ	κα	ς ς	β λγ	με	λη	ιζ κθ	α λβ	κε μδ	μγ	κγ
	β	ιγ	κβ	ζ	ιδ ιθ	μζ	μζ	ιη θ	β λθ	κζ κη	μ	κ
	γ	ιδ	κγ	ζ νη	κς ιζ	μθ	δ νς	μθ	γ μς	κθ ιβ	λς	ιη
	δ	ιε	κδ	η νς	ζ μθ	να	ε ε	ιθ κθ	δ νγ	νε	λγ	ις
	ε	ις	κε	θ νγ	ιθ νε	νγ	ιδ	κ ι	ς	β λθ	λ	ιδ
	ς	ιζ	κς	ι να	β μη	νε	κγ	ν	ζ ζ	δ κθ	κζ	ιβ
	ζ	ιη	κζ	ια μη	ιε θ	α νζ	λβ	κα λ	η ιδ	ς ιη	κδ	θ
	α	ιθ	κη	ιβ μς	κζ λθ	β	μα	κβ ι	θ κα	η ζ	κα	ζ
	β	κ	κθ	ιγ μδ	ι κ	β	ν	ν	ι κζ	θ νς	ιη	ε
	γ	κα	λ	ιδ μς	κγ ια	β ε	ς	κγ λα	ια λα	ια μζ	ιε	β
	δ	κβ	λα	ιε λθ	ς λ	ζ	η	κδ η	ιβ μδ	ιγ λζ	ια	ιδ
αὔγουστος	ε	κγ	α	ις λζ	κ ια	ι	ις	μδ	ιγ νε	ιε κη	η	ιγ νη
	ς	κδ	β	ιζ λε	ε ιβ	ιγ	κδ	κε κ	ιε η	ιζ ιη	ε	νς
	ζ	κε	γ	ιη λβ	ιθ κγ	ις	λβ	νς	ις κ	ιθ θ	κς β	νγ
	α	κς	δ	ιθ λ	δ ιγ	ιθ	μ	κς λβ	ιζ λβ	κ νθ	κε νθ	να
	β	κζ	ε	κ κη	ιθ ι	κβ	μη	κζ η	ιη μδ	κβ μδ	νε	μη
	γ	κη	ς	κα κς	δ νδ	κε	ς νς	μδ	ιθ νς	κδ λδ	νβ	μς
	δ	κθ	ζ	κβ κγ	ιη να	κη	ζ δ	κη κ	κα η	κς κα	μθ	μδ
μούχαραν	ε	α	η	κγ κα	β νβ	β λα	ζ ιβ	κη νς	κβ κ	κη η	κε μς	ιγ μα

a αἱ ἡμεραι b δελχήτζε c ἰούλλϊος

1 νγ in degree column.

2 ιε in degree column and cancelled.

f.165 MONTH 5

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♃	♓ τὸν ♄	♓ τὸν ☿	♓ τὸν ♀	♓ τὸν ☉	♓ τοὺς ☽	
	♈								προποδισμός ♃
ε ῥ	♈		XX ζ ῥ			XX ϛ ϭ			
	♉			□[4]ϛ ϭ	XX ϛ ῥ		XX ιγ ϭ		
ζ ῥ	♉	XX ζ ῥ				□ ζ ϭ		− ε ῥ	☉ ♂ ☿
	♊			Δ γ ϭ	□ ζ ῥ				
	♊					Δ ε ῥ	□ α ϭ	κκ θ ϭ	
ε ϭ	♋	□ ζ ϭ	♂ ζ ϭ					τα θ ϭ	♂ □ ♃
	♋				Δ ζ ϭ		Δ α ῥ		
ιγ ϭ	♋	Δ ε ῥ		− ζ ῥ					δύνει ☉ ἀνατολή
	♌								♂ XX ♄
	♌								♀ ♑
γ ϭ	♌		XX ε ϭ			− γ ϭ			♀ Δ ♃
	♌				− α ῥ				
α ῥ	♌		□ δ ῥ				− ιγ ϭ		☉ ☊
	♍	− θ ϭ		Δ γ ϭ					☉ □ ♃
	♍								
γ ϭ	♎		Δ δ ϭ	□ θ[5]ϭ		Δ γ ῥ			☉ XX ♄
	♎				Δ ϛ ῥ				
ιγ ϭ	♎			XX η ῥ				♂ ε ϭ	
	♏	Δ ιδ ϭ				□ ζ ϭ	Δ ϛ ϭ		
ζ ῥ	♏		− θ ῥ		□ ζ ϭ				
	♐					XX ϛ ῥ	□ ζ ῥ	ὕψωμα α ϭ	
η[1] ῥ	♐	□ α ϭ			XX α ῥ				
	♐			♂ θ ϭ					καῦμα ☉
	♐	XX ϛ ϭ					XX ζ ϭ		
ϛ[2] ϭ	♑		Δ γ ϭ						
	♑				♂ ι ῥ	♂ ζ ϭ			
[3] ϭ	♑		□ γ ϭ	XX ιβ ϭ					
	♑	♂ ϛ ῥ					♂ ζ ῥ		
[3] ϭ	♒		XX ζ ϭ	□ ε ῥ					

1 η very faint.
2 ϛ very faint.
3 illegible
4 MS has ☊.
5 θ superimposed on α.

f.165^{v}

MONTH 6

a	b	c	☉	☽	☿	♀	♂	♃	♄	☉	αἱ ♄
ς	β	θ	κδ ις	ις λε	β λδ	ζ κα	κθ λβ	κγ λδ	κθ νγ	κε μγ	ιγ λθ
ζ	γ	ι	κε ιδ	ιθ	λη	κη	ιη	κδ μη	α μβ	μ	λζ
α	δ	ια	κς ιγ	ιγ λδ	μβ	λε	μθ	κς α	γ λα[2]	λζ	λδ
β	ε	ιβ	κζ ια	κς κη	μς	μβ	α κη	κζ ιε	ε κ[3]	λγ	λα
γ	ς	ιγ	κη θ	θ ια	ν	μθ	β ζ	κη κη	ζ θ	λ	κθ
δ	ζ	ιδ	κθ ζ	κα μζ	νδ	ζ νε	μς	κθ μβ	η νς	κζ	κς
ε	η	ιε	ε	δ λα	β νη	η α	γ κε	νε	ι μα	κδ	κδ
ς	θ	ις	α γ	ιζ ιζ	γ β	ζ	δ δ	β θ	ιβ κς	κα	κα
ζ	ι	ιζ	β α	κθ μς	ς	ιγ	μγ	γ κβ	ιδ ια	ιζ	ιθ
α	ια	ιη	β νθ	ια μζ	ι	ιθ	ε κα	δ λς	ιε νς	ιδ	ις
β	ιβ	ιθ	γ νη	κγ λθ	γ ιγ	η κε	ε νθ	ε μη	ιζ μβ	ια	ιγ
γ	ιγ	κ	δ νς	ε κδ	ιη	λα	ς λθ	ζ	ιθ κ	η	ι
δ	ιδ	κα	ε νδ	ιζ κζ	κγ	λς	ζ ιη	η ιβ	κ νη	ε	η
ε	ιε	κβ	ς[1]νγ	κη νγ	κη	μα	νζ	θ κδ	κβ λς	κε α	ε
ς	ις	κγ	ζ να	ια κβ	λε	μς	η κς	ι λς	κδ ιδ	κδ νη	β
ζ	ιζ	κδ	η ν	κδ ιη	λη	να	θ ιε	ια μη	κε νγ	νε	ιγ
α	ιη	κε	θ μη	ζ η	με	η νς	νδ	ιγ	κζ ιζ	νβ	ιβ νζ
β	ιθ	κς	ι μς	κ γ	μη	θ α	ι λγ	ιδ κδ	κθ α	μθ	νδ
γ	κ	κζ	ια με	γ κε	νε	ς	ια κ	ιε κδ	λε	μς	να
δ	κα	κη	ιβ μγ	ιζ λ	γ νη	ια	να	ις λς	β θ	μγ	μη
ε	κβ	κθ	ιγ μβ	α κβ	δ ε	θ ις	ιβ κθ	ιζ μθ	γ μγ	μ	με
ς	κγ	λ	ιδ μ	ιε	ι	ιθ	ιγ ς	ιθ β	ε ι	λς	μβ
ζ	κδ	λα	ιε λθ	κη νβ	ιε	κβ	μβ	κ ιε	ς λς	λγ	μ
σεπτέμβριος α	κε	α	ις λη	ιγ ε	κ	κε	ιδ ιη	κα κη	η β	λ	λζ
N ε β	κς	β	ιζ λζ	κζ νδ	κε	κη	νδ	κβ μα	θ κη	κζ	λε
γ	κζ	γ	ιη λε	ιβ μα	λ	λα	ιε λ	κγ νε	ι νδ	κδ	λβ
δ	κη	δ	ιθ λδ	κη ιβ	λε	λδ	ις ς	κε η	ιβ ε	κ	κθ
ε	κθ	ε	κ λγ	ια νη	μ	λζ	μβ	κς κβ	ιγ ις	ιζ	κζ
σαφὰρ ς	α	ς	κα λα	κε λα	με	μ	ιζ ιη	κζ λε	ιδ κζ	ιδ	κδ
ζ	β	ζ	κβ λ	η νς	δ ν	θ μγ	ιζ νδ	κη μη	ιε λη	κδ ια	ιβ κα

a αἱ ἡμέραι b μούχαραμ c αὔγουστος

1 confused superposition of characters, ς inferred.

2 stained area: α faint.

3 stained area: κ or ν; κ inferred.

f.166 MONTH 6

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♃	♓ τὸν ♄	♓ τὸν ☉	♓ τὸν ♀	♓ τὸν ☿	♓ τοὺς ☽	
	♓					XX ζ ρ		− θ ρ	
ς δ	♒			Δ ζ ρ	XX ζ δ			☉ ∧	☿ ♓
	♒							κκ ζ ρ	☿ XX ♎
ιβ δ	♒	XX η δ	ὃ ς ρ		□ ε ρ	□ η δ		τα ζ ρ	
	♑						XX β δ		☿ □ ♑
η ρ	♑	□ ι ρ				Δ η ρ			☉ □ ♎
	♐			− γ ρ	Δ δ δ		□ ς ρ		♀ ∧
	♐								♀ □ ♎
ζ δ	♐	Δ ι δ	XX α ρ						☿ ὑψοῦται
	♈						Δ δ ρ		♂ XX ♎
ς ρ	♈								♀ ὃ ☉
	♉		□ β δ	Δ α ρ	− η δ	− ι δ			
	♉								♀ XX ♑
θ δ	♉	− η ρ	Δ ε ρ						
	♊			□ α δ					
α ρ	♊						− θ δ	ὃ θ δ ☿ ≈	♂ □ ♑
	♊			XX η δ	Δ ιβ δ	Δ ς ρ			φάνει ☿ δυτική
	♊								☿ ≏
ϛ δ	♋	Δ η ρ	− ζ δ		□ η ρ			ὕψωμα ς δ	
	♋					□ δ δ			
β δ	♋			ὃ η ρ			Δ β δ		
	♋	□ δ δ			XX β δ	XX β ρ			
θ δ	♋		Δ ε ρ				□ ζ ρ		
	♌	XX ϛ ρ							
θ δ	♌		□ ς ρ						☿ Δ ♑
	♌			XX ϛ δ	ὃ α ρ		XX β δ		
ζ δ	♌		XX ς ρ			ὃ ϛ δ			
	♍	ὃ ια ρ		□ α δ					
ι δ	♍							− δ δ	
	♎			Δ η δ	XX η ρ		ὃ ζ ρ		

f.166ᵛ

MONTH 7

a	b	c	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
α	γ	η	κγ κθ	κβ ζ	δ νς	θ μς	ιη λ	β	ις να	κδ η	ιβ ιη
β	δ	θ	κδ κη	ε γ	ε β	μζ	ιθ θ	α ις	ιζ μη	ε	ιε
γ	ε	ι	κε κζ	ιζ μα	η	μη	μη	β λ	ιη με	κδ β	ιβ
δ	ς	ια	κς κς	ι ς	ιδ	μθ	κ κζ	γ μγ	ιθ μβ	κγ νη	ι
ε	ζ	ιβ	κζ κε	ιβ κς	κ	ν	κα ς	δ νη	κ λθ	νε	ζ
ς	η	ιγ	κη κδ	κδ νβ	κζ	να	με	ς ιβ	κα λς	νβ	ε
ζ	θ	ιδ	κθ κγ	ζ λε	λγ	νβ	κβ κδ	ζ κς	κβ ιγ	μθ	β
α	ι	ιε	κβ	κ ις	λθ	νγ	κγ γ	η μ	κς	μς	ιβ ϛ
β	ια	ις	α κα	α ιγ	με	νδ	μβ	θ νδ	κγ λ	μβ	ια νζ
γ	ιβ	ιζ	β κα	ιγ κ	να	νε	κδ κα	ια κ	κδ λη	λθ	νε
δ	ιγ	ιη	γ κ	κε λγ	ε νη	νε	νζ	ιβ κδ	μη	λς	νβ
ε	ιδ	ιθ	δ ιθ	ζ νθ	ς δ	νε[2]	κε λς	ιγ λη	νη	λγ	ν
ς	ιε	κ	ε ιθ	κ λζ	ι	νδ[3]	κς ιε	ιδ νβ	κε ζ	λ	μζ
ζ	ις	κα	ς ιη	α ε	ιζ	νγ	νδ	ις ς	ιζ	κς	μδ
α	ιζ	κβ	ζ ιη	ιε λ	κδ	νβ	κζ λγ	ιζ κ	κε κς	κγ	μα
β	ιη	κγ	η ιζ	κθ μα	λα	να	κη κ	ιη λδ	ιε	κ	λη
γ	ιθ	κδ	θ ιζ	ιγ γ	λη	ν	να	ιθ μη	δ	ιζ	λε
δ	κ	κε	ι ις	κς μγ	με	μη	κθ λ	κα β	κδ νγ	ιδ	λβ
ε	κα	κς	ια ις	ιβ με	νβ	μς	θ	κβ ις	μ	ια	κθ
ς	κβ	κζ	ιβ ιε	κζ ιβ	ς νθ	με	κζ	κγ λ	κθ	η	κς
ζ	κγ	κη	ιγ ιε	ια ιζ	ζ ς	μγ	μζ	κδ μ	κγ νη	ε	κγ
α	κδ	κθ	ιδ ιδ	κε α	ιγ	μα	α κδ	κε νε	κζ	κγ α	κ
β	κε	λ	ιε ιδ	η να	κ	λθ	β α	κζ ια	κβ νς	κβ νη	ιζ
ὀκτώβριος[1] γ	κς	α	ις ιδ	κγ ς	κς	λζ	λη	κη κς	κε	νε	ιδ
κύκλος ϐ ιγ δ	κζ	β	ιζ ιδ	ζ κ	λβ	λδ	γ ιε	κθ μβ	κα νβ	νβ	ια
ε	κη	γ	ιη ιγ	κα ιγ	λη	λα	νβ	νζ	ιε	μθ	η
ς	κθ	δ	ιθ	δ μα	μδ	κη	δ κθ	β ιγ	κ λη	με	ε
ζ	λ	ε	κ	ιζ λθ	ν	κε	ε ς	γ κη	α	μβ	ια β
ῥαπϊελάβελ α	α	ς	κα	κε	ζ νς	κβ	μγ	δ μδ	ιθ κδ	λθ	ι νθ
β	β	ζ	κβ ιγ	ιγ μζ	η β	θ ιθ	ς κ	ε νθ	ιθ	κβ λς	ι νς

a αἱ ἡμέραι b σαφὰρ c σεπτέμβριος
1 MS ὁκτόβριος
2 ε superimposed on δ.
3 δ superimposed on γ.

f.167 MONTH 7

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♃	♓ τὸν ♄	♓ τὸν ☉	♓ τὸν ♀	♓ τὸν ☿	♓ τοὺς ☽	
ι ρ	♒					XX ζ ρ		κκ α δ	♀ ♍
	♍		ὃ ς δ					τα α δ	♂ ≈ Θ[3]
	♍	XX ι ρ			□ ι δ				
ς δ	♐			− ι ρ		□ α ρ			
	♐								♀ XX ♃
ε ρ	♐	□ α ρ			Δ η δ	Δ η δ[2]	XX η δ		☿ XX ☉
	♑		XX γ δ			Δ ς δ			
	♑						□ ι δ		
δ δ	♒	Δ ς δ	□ γ ρ	Δ ι ρ					♀ □ ♄
	♒								☿ XX ☉
ε ρ	♒				− δ δ		Δ ς δ		
	♓		Δ ι δ	□ θ δ					ἀναποδισμός ♄
	♓					− ς ρ		ὃ α ρ	
δ ρ	♈	− δ ρ		XX ια ρ					
	♈						− ι ρ		
ζ δ	♈		− ια ρ		Δ γ δ			ὕψωμα α ρ	
	♉					Δ ς ρ			♂ Δ ♄
α ρ	♉				□ β ρ				ἀναποδισμός ☿
	♊	Δ ε δ		ὃ η δ		□ ι ρ	Δ θ ρ	☉ ♍	♀ ≈ Θ[3]
α ρ	♊		Δ ι ρ		XX γ ρ				
	♋	□ η δ							
ε ρ	♋					XX ζ δ	□ β δ		ταπείνωμα ♀
	♌	XX ς ρ	□ ε[1] δ	XX ς δ					
η ρ	♌				ὃ ια ρ		XX γ δ		
	♍		XX ς δ	□ ς δ					♀ ♒
ια ρ	♍							− ς δ	
	♒			Δ α ρ		ὃ β δ			
	♒	ὃ η ρ					ὃ α ρ	κκ ι δ	καῦμα ☿
ε δ	♍		ὃ ι ρ		XX ς ρ				δύνη ☊
	♍								

1 ε superimposed on ς.
2 Δ η δ cancelled.
3 MS omits Θ.

f.167^{v}

MONTH 8

	a	b	c	☿ ♂	☿ ☾	☿ ♃	☿ ♄	☿ ☉	☿ ♀	☿ ☿	☿ ☊	
	γ	γ	η	κγ ιβ	κε μα	η η	θ ιϛ	ϛ νϛ	ζ ιε	ιη μϛ	κβ λβ	ι νγ
	δ	δ	θ	κδ	ζ νγ	ιε	ιβ	ζ λα	η λ	κη	κθ	ν
	ε	ε	ι	κε	ιθ νγ	κβ	η	η ϛ	θ με	ι	κϛ	μη
	ϛ	ϛ	ια	κϛ	α νβ	κθ	δ	μα	ια	ιζ νβ	κβ	με
	ζ	ζ	ιβ	κζ	ιγ νβ	λϛ	θ	θ ιϛ	ιβ ιε	λδ	ιθ	μβ
	α	η	ιγ	κη	κϛ κα	μγ	η νε	να	ιγ λ	ιη	ιϛ	λθ
	β	θ	ιδ	κθ	θ ζ	μθ	ν	ι κϛ	ιδ με	κδ	ιγ	λζ
	γ	ι	ιε	ιβ	κα μδ	η νϛ	με	ια α	ιϛ	λ	ι	λδ
	δ	ια	ιϛ	α ιγ	δ θ	θ ε	μ	λζ	ιζ ιϛ	λϛ	ϛ	λα
	ε	ιβ	ιζ	β ιγ	ιϛ λε	ια	λε	ιβ ιβ	ιη λβ	λβ	γ	μη
	ϛ	ιγ	ιη	γ ιδ	κθ ιθ	κβ	λ	μη	ιθ μη	ιζ ν	κβ	κε
	ζ	ιδ	ιθ	δ ιδ	ιβ ιβ	κθ	κϛ	ιγ κδ	κα κ	ιη ιγ	κα νζ	κβ
	α	ιε	κ	ε ιε	κδ ιε	λϛ	κβ	ιδ	κβ λϛ	λϛ	νδ	κ
	β	ιϛ	κα	ϛ ιε	η ιγ	μγ	ιη	λϛ	κγ νβ	νθ	ν	ιζ
	γ	ιζ	κβ	ζ ιϛ	κγ ιβ	ν	η γ	ιε ιβ	κε η	ιθ κβ	μζ	ιε
	δ	ιη	κγ	η ιϛ	ζ ιδ	θ νη	ζ νη	μη	κϛ κγ	μγ	μδ	ιβ
	ε	ιθ	κδ	θ ιζ	κα μδ	ι ε	νγ	ιϛ κδ	κζ λη	κ μθ	μα	ι
	ϛ	κ	κε	ι ιζ	ϛ κη	ιβ	μη	ιζ	κη νγ	κα νδ	λη	ζ
	ζ	κα	κϛ	ια ιη	κα ιζ	ιθ	μγ	λϛ	η	κβ νθ	λε	ε
	α	κβ	κζ	ιβ ιθ	ε λζ	κϛ	λϛ	ιη ιδ	α ιε	κδ δ	λβ	ι β
	β	κγ	κη	ιγ ιθ	ιθ κϛ	λδ	κθ	να	β κβ	κε θ	κθ	θ νθ
	γ	κδ	κθ	ιδ κ	δ κθ	μα	κγ	ιθ κϛ	γ λθ	κϛ ιη	κε	νϛ
	δ	κε	λ	ιε κ	ιη α	μη	ιζ	κ α	δ νε	κζ κη	κβ	νδ
	ε	κϛ	λα	ιϛ κα	α κϛ	ι νε	ια	λϛ	ϛ ια	κη[1] λη[2]	ιθ	νβ
νοέμβριος	ϛ	κζ	α	ιζ κβ	ιγ λγ	ια β	ζ ε	κα ια	ζ κζ	κθ μη[3]	ιϛ	μθ
	ζ	κη	β	ιη κβ	κζ κα	ι	ϛ νθ	μϛ	η μγ	νη	ιγ	μϛ
	α	κθ	γ	ιθ κγ	θ νθ	ιζ	νδ	κβ κ	θ νθ	β κ	θ	μγ
ῥαπϊελάχηρ	β	α	δ	κ κγ	κα νδ	κδ	μθ	νδ	ια ιε	γ μβ	ϛ	μα
	γ	β	ε	κα κδ	δ η	λα	μδ	κγ ιη	ιβ λα	ε δ	γ	λη
	δ	γ	ϛ	κβ κδ	ιϛ νϛ	ια λη	ϛ λη	κδ β	ιγ μζ	ϛ κϛ	κα	θ λε

a αἱ ἡμέραι b ῥαπϊελάβελ c ὀκτώβριος, MS ὀκτόβριος

1 Stain, η inferred
2 Stain, λη inferred
3 Stain, η inferred

f.168 MONTH 8

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♃	♓ τὸν ♄	♓ τὸν ☿	♓ τὸν ♀	♓ τὸν ☉	♓ τοὺς ☽	
δ ῥ	♓								
	♈			− η ὁ	□ ε ὁ	ΧΧ ς ὁ			♀ △ ♄
	♈	ΧΧ ε ῥ					ΧΧ β ὁ		☿ ΧΧ ♃
α ὁ	♉		ΧΧ η ῥ		△ ι ῥ				
	♉					□ β ὁ	□ β ῥ		φαίνεται ☿ εἰς ἀνατολήν
γ ῥ	♉	□ θ ὁ							
	♊		□ δ ὁ	△ ε ὁ		△ η ῥ	△ ιβ ῥ		
ιβ ῥ	♊								
	♋	△ ϟ ὁ	△ ε ῥ	□ ε ῥ	− ια ῥ				προποδισμός ☿
	♋							ὃ η ῥ	☿ ὃ ♀
ζ ὁ	♋			ΧΧ ι ῥ					
	♈						− η ῥ		
η ῥ	♈					− α ὁ		ὕψωμα ζ ῥ	
	♌	− β ὁ	− ς ὁ		△ η ῥ				
ι ῥ	♌								
	♊			ὃ ε ὁ	□ η ῥ				
ιβ ῥ	♊					△ η ῥ	△ γ ὁ		καῦμα ♃
	♑	△ ε ῥ	△ ε ῥ		ΧΧ ι ῥ				♀ ♓
ια ῥ	♑					□ ι ῥ	□ ζ ὁ		
	♐	□ ι ῥ	□ η ῥ	ΧΧ α ῥ					
ιβ ῥ	♐						ΧΧ η ῥ		
	♍	ΧΧ ιβ ῥ	ΧΧ θ ῥ	□ α ῥ		ΧΧ γ ὁ			
	♍				ὃ ϟ ῥ			− β ῥ	
β ὁ	♎			△ ζ ῥ					☿ ≈ Θ[2]
	♎							κκ η ῥ	☿ ♓
β ῥ	♎	ὃ β ὁ[1]					ὃ δ ῥ	τα η ῥ	
	♓		ὃ θ ὁ			ὃ ε ὁ			
η ῥ	♓	ὃ β ὁ			ΧΧ ζ ὁ				♀ ὃ ♃
	♈			− α ῥ					φαίνεται ♃
	♈				□ ι ῥ				

1 ὃ β ὁ cancelled.
2 MS omits Θ.

f.168^{v}

MONTH 9

	a	b	b	♈	♉	♊	♋	♌	♍	♎	♏	♐
	ε	δ	ζ	κγ νη	κθ β	ια μς	ς λα	κδ λε	ιε α	ζ μη	κ νζ	θ λβ
	ς	ε	η	κδ κε	ι νδ	νδ		κβ	κε ς	ις ις	θ λβ	νδ	λα
	ζ	ς	θ	κε κς	κβ μ	ιβ α		ιγ	λζ	ιζ λβ	ια ις	να	κθ
	α	ζ	ι	κς κζ	γ κβ	η		ς δ	κς η	ιη μη	ιγ	μζ	κη
	β	η	ια	κζ κη	ιε λδ	ιε		ε νε	λθ	κ δ	ιδ μδ	μδ	κς
	γ	θ	ιβ	κη κθ	κη ιζ	κβ		με	κζ ι	κα κ	ις κη	μα	κε
	δ	ι	ιγ	κθ λ	ια ις	κθ		λς	μα	κβ λς	ιζ ν	λη	κγ
	ε	ια	ιδ	λα	κδ η	λς		κζ	κη ιβ	κγ νβ	ιθ ιβ	λε	κα
	ς	ιβ	ιε	α λβ	ζ ζ	μγ		ιη	μβ	κε η	κα λδ	λα	κ
	ζ	ιγ	ις	β λγ	κ κα	ν		ε θ	κθ ιβ	κς κδ	κβ νς	κη	ιθ
	α	ιδ	ιζ	γ λδ	γ νε	ιβ νη		δ νθ	κθ μβ	κζ μ	κγ ιθ	κε	ιζ
	β	ιε	ιη	δ λε	ιζ μγ	ιγ ε		ν	ιθ	κη νς	κε	κβ	ιε
	γ	ις	ιθ	ε λς	β κ	ιγ		μα	νς	ιβ	κς μβ	ιθ	ιδ
	δ	ιζ	κ	ς λζ	ις μγ	κ		λγ	α λδ	α κη	κη κδ	ιε	ιβ
	ε	ιη	κα	ζ λη	ιθ	κη		κε	β ια	β μδ	ς	ιβ	ι
	ς	ιθ	κβ	η λθ	ις κη	λε		ιζ	μη	δ	α μζ	θ	θ
	ζ	κ	κγ	θ μ	α κε	μγ		θ	γ κς	ε ις	γ κθ	ς	ζ
	α	κα	κδ	ι μβ	ις ιζ	ν		δ α	δ γ	ς λβ	ε ια	γ	ς
	β	κβ	κε	ια μγ	μα	ιγ νζ		γ νγ	μ	ζ μη	ς νγ	κ	ε
	γ	κγ	κς	ιβ μδ	ιδ λβ	ιδ δ		με	ε ιζ	θ δ	η λε	ιθ νζ	δ
	δ	κδ	κζ	ιγ με	κζ νθ	ια		λζ	ε νε	ι κβ	ι ιε	νδ	γ
	ε	κε	κη	ιδ μδ	ια ιε	ιη		κθ	ς κζ	ια λς	ιβ β	ν	β
	ς	κς	κθ	ιε μη	κδ ιη	κε		κα	ζ	ιβ ν	ιγ μθ	μζ	α
	ζ	κζ	λ	ις μθ	ζ γ	λα		ιγ	λβ	ιδ δ	ιε λς	μδ	θ
δεκέμβριος	α	κη	α	ιζ ν	ιθ λε	λζ		γ ε	η δ	ιε ιη	ιζ κγ	μα	η νθ
	β	κθ	β	ιη νβ	α ις	μγ		β νη	λζ	ις λβ	ιθ θ	λη	
	γ	λ	γ	ιθ νγ	ιγ γ	μθ		να	θ θ	ιζ μς	κ νς	λδ	νη
τζημϊλάβελ	δ	α	δ	κ νδ	κδ νζ	ιδ νε		μδ	μα	ιθ	κβ μγ	λα	νζ
	ε	β	ε	κα νε	ς να	ιε α		λη	ι ιδ	κ ιδ	κδ λ	κη	
	ς	γ	ς	κβ νζ	ιθ ιβ	ιε ζ		β λβ	ι μζ	κα κη	κς ις	ιθ κε	νς

a αἱ ἡμέραι b ῥαπϊελάχηρ c νοέμβριος

f.169 MONTH 9

ὁδὸς ♐	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♊	♓ τὸν ♑	♓ τὸν ♓	♓ τὸν ♎	♓ τὸν ♑	♓ τοὺς ♐	
ζ ὁ	♐								
	♈		XX ζ ὁ			XX η ρ	XX β ὁ		
ιγ ρ	♈	XX β ρ			△ α ρ				♑ ὅ τὸν ♊
	♒		□ ιβ ρ	△ α ρ					♂ XX τὸν ♓
	♒					□ ε ρ	□ α ὁ		δύσις ἑῴα ♑
θ ὁ	♒	□ ε ρ							
	♉		△ ζ ὁ	□ ζ[1] ρ			△ ι ρ	ὅ ι ρ	
ζ ρ	♉	△ ι ρ			− δ ρ	△ δ ὁ			
	♈			XX ε ρ					δύσις ἑῴα ♎
ιγ ρ	♈								
	♉		− ιβ ρ					ὕψωμα γ ὁ	♓ εἰς τὸν ♒
	♉						− ιβ ρ		♂ ∞ τὸν ♑
α ὁ	♊	− β ρ		ὅ α ρ	△ ϟ ὁ	− α ὁ			♎ εἰς τὸν ♐
	♊								♎ XX τὸν ♓
ε ὁ	♋				□ α ρ				♑ εἰς τὸν ♐
	♋		△ ϟ ὁ						♎ ∞ τὸν ♑
γ ὁ	♌	△ ιβ ρ		XX β ρ	XX α ρ	△ ε ρ	△ α ρ		♑ XX τὸν ♓
	♌		□ ϟ ὁ						♑ ∞ τὸν ♑
δ ὁ	♍			□ δ ρ		□ [2] ρ	□ η ρ		
	♍	□ β ὁ	XX ε ὁ					− ε ρ	
α ρ	♍			△ ζ ρ	ὅ ι ρ				♑ ὅ τὸν ♎
	♎	XX β ρ				XX ε ὁ	XX ζ ὁ	κκ ι ρ	
ζ ρ	♎							τα ι ρ	
	♏		ὅ ι ρ						
	♏								καῦμα ♑
γ ὁ	♐			− α ρ	XX ι ρ				
	♐	ὅ ι ρ				ὅ ε ρ	ε ρ[3]		
ϛ ρ	♐								
	♑		XX ια ρ		□ γ ρ				
	♑								

1 ζ superimposed on ϟ.
2 α and other letters superimposed.
3 erasure, only ρ clear.

f.169v

MONTH 10

	a	b	☽	☾	☿	♃	♂	♀	☉	♁	♄
	ζ	δ	ζ	κγ νη	νθ	ιε ιγ	β κγ	ια ιθ	κβ μ	κη γ	ιθ κα	η νε
	α	ε	η	κδ νθ	ιβ μζ	κ	ιζ	νβ	κγ νζ	κθ μθ	ιη	
	β	ζ	θ	κζ α	κδ κθ	κζ	θ	ιβ κδ	κε ιβ	α λε	ιε	
	γ	ζ	ι	κζ β	ζ μ	λδ	β β	νζ	κζ κη	γ κα	ια	
	δ	η	ια	κη γ	ιθ ιε	μα	α νζ	ιγ κη	κζ μδ	ε η	η	
	ε	θ	ιβ	κθ δ	β ιε	μη	ν	ιδ	κθ	ζ νε	ε	
	ζ	ι	ιγ	ζ	ιε κ	ιε νε	μδ	λβ	ιζ	η λζ	ιθ β	
	ζ	ια	ιδ	α ζ	κη κ	ιζ β	λη	ιε δ	α λβ	ι ιζ	ιη νθ	
	α	ιβ	ιε	β η	ιβ ια	θ	λβ	λζ	β μη	ια νη	νε	
	β	ιγ	ιζ	γ ι	κζ κδ	ιε	κζ	ιζ η	δ δ	ιγ λθ	νβ	
	γ	ιδ	ιζ	δ ια	ι μη	κα	κ	λζ	ε κ[1]	ιε κβ	μθ	
	δ	ιε	ιη	ε ιβ	κε μζ	κζ	ιε	ιζ η	ζ λζ	ιζ β	μζ	
	ε	ιζ	ιθ	ζ ιδ	ι κγ	λγ	ι	λθ	ζ νβ	ιη μβ	μγ	νε
	ζ	ιζ	κ	ζ ιε	κδ λη	λθ	ε	ιη ι	θ η	κ κα	λθ	νζ
	ζ	ιη	κα	η ιζ	θ κα	με	α	μα	ι κδ	κβ α	λζ	
	α	ιθ	κβ	θ ιζ	κδ ζ	ν	ϛ νζ	ιθ ιβ	ια μ	κγ μα	λγ	νζ
	β	κ	κγ	ι ιθ	θ ια	ιζ νζ	νβ	μγ	ιβ νζ	κε ιγ	λ	
	γ	κα	κδ	ια κ	κγ λ	ιζ α	μη	κ ιδ	ιδ ιβ	κζ με	κζ	νη
	δ	κβ	κε	ιβ κα	ζ κζ	ζ	μδ	μδ	ιε κη	κη ιζ	κδ	
	ε	κγ	κζ	ιγ κβ	κ νη	ιβ	λθ	κα ιδ	ιζ μδ	κθ μθ	κα	νθ
	ζ	κδ	κζ	ιδ κδ	γ νθ	ιθ	λγ	μδ	ιη α	α κα	ιη	η νθ
	ζ	κε	κη	ιε κε	ιζ λζ	κδ	λ	κβ ιδ	ιθ ιζ	β μδ	ιδ	θ
	α	κζ	κθ	ιζ κζ	κη νδ	κθ	κζ	μδ	κ λγ	δ ζ	ια	β
	β	κζ	λ	ιζ κζ	ι νε	λδ	κδ	κγ ιδ	κα μθ	ε λ	η	γ
	γ	κη	λα	ιη κη	κβ να	λθ	κα	μδ	κγ ε	ζ νγ	ε	δ
ἰαννουάριος	δ	κθ	α	ιθ λ	δ μζ	μδ	ιη	κδ ιγ	κδ κα	η ιδ	ιη β	ε
κύκλος ε̄ ☽	ε	λ	β	κ λα	ιε μθ	μθ	ιε	μγ	κε λζ	θ ιη	ιζ νη	ζ
τζηματιλάχειρ	ζ	α	γ	κα λβ	κζ λζ	νδ	ιβ	κε ιγ	κζ νγ	ι κβ	νε	η
	ζ	β	δ	κβ λγ	ι κθ	ιζ νθ	θ	μγ	κη θ	ια κζ	νβ	ι
	α	γ	ε	κγ λδ	κβ ιθ	ιη δ	ϛ ζ	κζ ιβ	κθ κε	ιβ λ	ιζ μθ	θ ια

a τζημϊλάβελ b δεκέμβριος

1 κ superimposed on ϛ.

f.159 MONTH 10

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ☊	♓ τὸν ♃	♓ ☿	♓ ♀	♓ ☉	♓ τοὺς ☿	
γ ὁ	♒			Δ ς ὁ					
	♒		□ α ῥ		Δ γ ὁ				☿ εἰς τὸν ♑
ς ῥ	♒	XX ϛ ῥ		□ ιβ ῥ		XX β ὁ	XX ι ῥ		
	♓		Δ ιγ ῥ						
	♓	□ ιγ ῥ				□ ιβ ῥ		ὃ ε ὁ	
α ὁ	♈			XX β ὁ			□ ϛ ὁ		καῦμα ♀
	♈				− β ὁ				♀ εἰς τὸν ♑
α ῥ	♈	Δ α ῥ				Δ α ῥ		ὕψωμα θ ῥ	
	♉		− δ ῥ				Δ δ ὁ		
γ ῥ	♉			ὃ ε ῥ					
	♊				Δ η ῥ				☿ XX ☊
ε ῥ	♊	− ιβ ῥ							♀ □ ♂
	♋		Δ ς[1] ῥ		□ θ ῥ	− α ῥ	− ιβ ῥ		☿ □ τὸν ♂
η ῥ	♋			XX ι ῥ					
	♌		□ ι ῥ		XX ιγ ῥ				
η ῥ	♌			□ θ ῥ					
	♍	Δ ε ὁ	XX ια ῥ			Δ δ ῥ		− η ῥ	φάσις ἑσπέριος ☿
ι ῥ	♍			Δ ια ῥ			Δ ϛ ὁ		
	♎	□ ε ῥ				□ η ῥ			☿ Δ τὸν ♃
ιγ ῥ	♎				ὃ ζ ὁ			κκ δ ὁ	♀ XX ☊
	♏						□ α ὁ	τα δ ὁ	☿ εἰς τὸν ♒
	♏	XX γ ὁ	− ς ὁ			XX β ῥ			
α ῥ	♏			− α ῥ			XX ε ῥ		
	♐								♂ XX ☊
ι ῥ	♐				XX ς ὁ				♀ □ τὸν ♂
	♑								
	♑	ὃ ε ῥ	Δ α ῥ						
α ῥ	♑			Δ α ῥ	□ ε ὁ	ὃ ς ὁ			
	♒		□ ιβ ῥ				ὃ ς ὁ		
	♒				Δ ι ῥ				♀ Δ τὸν ♃

1 ς superimposed on another letter.

f.159^{v}

MONTH 11

	a	b	☿ ♂	☿ ☽	☿ ♃	☿ ♄	☿ ☉	☿ ♀	☿ ☿	☿ ☊	☿ ☋	
	β	δ	ς	κδ λδ	δ δ	ιη θ	δ	κς μβ	μα	ιγ λβ	ιζ μς	θ ιγ
	γ	ε	ζ	κε λε	ιε κγ	ιγ	β	κζ ι	α νς	ιδ ιζ	μζ	ιδ
	δ	ς	η	κς λς	κζ μ	ιζ		λς	γ ιβ	ιε β	μ	ιε
	ε	ζ	θ	κζ λζ	ι κ	κα	κθ νη	κη ς	δ κζ	μζ	λς	ις
	ς	η	ι	κη λη	κγ κα	κε	νς	λδ	ε μγ	ις λα	λγ	ιη
	ζ	θ	ια	κθ λθ	ς μ	κθ	νδ	κθ β	ς νη	ιζ ιε	λ	κ
	α	ι	ιβ	μ	κ ιη	λγ	κθ νγ	λ	η ιδ	κς	κζ	κβ
	β	ια	ιγ	α μα	δ κγ	λζ		κθ νη	θ κθ	λζ	κδ	κδ
	γ	ιβ	ιδ	β μβ	ιη νς	μα		κς	ι με	μζ	κ	κς
	δ	ιγ	ιε	γ μγ	γ λδ	με		νδ	ιβ	ιζ νζ	ιζ	κη
	ε	ιδ	ις	δ μδ	ιθ λ	μθ		α κα	ιγ ιζ	ιη ζ	ιδ	λ
	ς	ιε	ιζ	ε με	δ ια	νδ	νγ	μς	ιδ λβ	ιη β	ια	λγ
	ζ	ις	ιη	ς μς	ιη νδ	ιη νη	νδ	β ιβ	ιε μζ	ιζ νζ	η	λς
	α	ιζ	ιθ	ζ μζ	γ ιγ	ιθ γ	νε	λη	ιζ β	νβ	δ	λθ
	β	ιη	κ	η	ιζ λζ	ζ	νς	γ δ	ιη ιζ	μζ	ιζ α	μβ
	γ	ιθ	κα	θ μη	α νη	ια	νζ	λ	ιθ λβ	ιζ μβ	ις νη	με
	δ	κ	κβ	ι μθ	ιε μγ	ιε	νη	νς	κ μζ	ις κδ	νε	μη
	ε	κα	κγ	ια ν	κθ ιδ	κ	κθ νθ	δ κβ	κβ γ	ιε ς	νβ	ν
	ς	κβ	κδ	ιβ	ιβ μβ	κδ		μη	κγ ιη	ιγ μη	μθ	νδ
	ζ	κγ	κε	ιγ να	κε με	κη	α	ε ιδ	κδ λδ	ιβ λ	μς	νζ
	α	κδ	κς	ιδ νβ	η κ	λβ	β	μ	κε νβ	ια ιβ	μγ	θ νθ
	β	κε	κζ	ιε	κ μα	λε	γ	ς γ	κζ ζ	θ νδ	λθ	ι α
	γ	κς	κη	ις νγ	α λζ	λζ	ς	κς	κη κβ	η λς	λς	γ
	δ	κζ	κθ	ιζ	ιγ κ	λθ	θ	μθ	κθ λζ	ζ ιη	λγ	ε[2]
	ε	κη	λ	ιη νδ	κε ς	μα	ιβ	ζ ιγ	νβ	ε	λ	ζ
	ς	κθ	λα	ιθ	ς νθ	μγ	ιε	λζ	β ζ	δ μα	κζ	θ
φεβρουάριος	ζ	λ	α	κ	ιη[1] κδ	με	ιη	η α	γ κβ	κβ	κγ	ια
ῥατζάπ	α	α	β	κα νε	κγ	μζ	κα	κε	δ λζ	γ γ	κ	ιγ
	β	β	γ	κβ	ιγ β	μθ	κδ	μθ	ε νβ	μδ	ιζ	ις
	γ	γ	δ	κγ νς	κε θ	ιθ να	κζ	θ ιγ	ζ ζ	γ κε	ις ιδ	ι ιθ

a τζηματιλάχειρ b ἰαννουάριος
1 η partly erased
2 ε inferred

f.170 MONTH 11

ὁδὸς ♌	♓ τὰ ζῴδια	♓ τὸν ♂	♓ ♍	♓ τὸν ♃	♓ ♀	♓ ☿	♓ ☽	♓ ♐	
	♈								☿ εἰς τὸν ♒
	♈		Δ α ℞					ὃ ε ♁	φάσις ☿ δυτική
α ℞	♈	XX γ ♁		XX α ℞		XX ε ℞			
	♉						XX ζ ℞		♁ ♃ εἰς τὸν ♉
ι ℞	♉	□ ε ℞				− ε ℞	□[1]		♂ □ ♀
	♉							ὕψωμα α ♁	♂ △ ♃
ιβ ℞	♉		− α ♁	ὃ ιβ ℞			□ ϛ ♁		στηριγμός ♃
	♊	Δ ϛ ♁				Δ ε ℞			
	♊						Δ γ ♁		♀ εἰς τὸν ♏
ϛ ♁	♋					Δ α ♁			δύσις ☽ δυτική
	♋		Δ γ ♁	XX ιβ ℞					προποδισμός ♃
ϛ ♁	♌	− η ♁				□ ϛ ♁			☽ □ ♍
	♌		□ ε ♁	□ ιγ ℞		− ϛ ♁	− δ ♁		στηριγμός ☽
ϛ ♁	♍					XX ϛ ♁			☽ ὃ ☿
	♍		XX θ ♁					− ε ♁	ἀναποδισμός ☽
δ ♁	♎	Δ ια ℞		Δ α ♁					☿ □ ♍
	♎					Δ ϛ ℞	Δ ϛ ♁	κκ α ℞	
ζ ♁	♎					ὃ ε ℞		τα α ℞	
	♏	□ ε ♁	ὃ ι ℞				□ ζ ♁		καῦμα ☽
ε ℞	♏			− ε ℞			□ δ ♁		♃ εἰς τοὺς ♊
	♐	XX ι ℞					XX α ℞		
	♐					XX θ ℞			☿ εἰς τὸν ♓ ☿ □ τὸν ♃
γ ♁	♐				XX ε ℞				
	♑		XX θ ℞						♂ □ ♍ φάσις ☽ ἑῴα
ε ℞	♑			Δ ε ℞					
	♒				□ ε ♁		ὃ α ♁		
	♒	ὃ ϛ ℞	□ ζ ♁						
δ ♁	♓			□ ε ♁	Δ ια ℞	ὃ δ ℞			
	♓		Δ θ ℞					ὃ β ℞	
	♓			XX ϛ ℞					

1 □ written in error.

f.170^{v}

MONTH 12

	a	b	c	Θ ϑ	Θ ζ	Θ π	Θ ц	Θ φ	Θ ϙ	Θ χ	Θ θ	Θ ϕ
	δ	δ	ε	κδ νζ	ζ ια	ιθ νγ	λ	θ λζ	η κβ	γ η	ις ια	ι κβ
	ε	ε	ς	κε	ιθ μθ	νε	λδ	ι	θ λς	γ β	η	κε
	ς	ς	ζ	κς νζ	β λς	νζ	λθ	κβ	ι να	β νς	ε	κη
	ζ	ζ	η	κζ νη	ιε νη	ιθ νθ	μδ	μδ	ιβ ε	ν	ις α	λα
	α	η	θ	κη	κθ μς	κ α	μθ	ια ς	ιγ κ	μδ	ιε νη	λδ
	β	θ	ι	κθ νη	ιγ λθ	γ	νδ	κη	ιδ λδ	β λη	νε	λζ
	γ	ι	ια	νθ	κζ νθ	δ	νθ	ν	ιε μθ	γ κζ	νβ	μ
	δ	ια	ιβ	α	ιβ να	ς	α δ	ιβ ιβ	ιζ γ	δ ις	μθ	μγ
	ε	ιβ	ιγ	β	κζ μη	η	θ	λδ	ιη ιη	ε ε	με	μς
	ς	ιγ	ιδ	γ	ιβ λθ	ι	ιδ	νς	ιθ λγ	νδ	μβ	μθ
	ζ	ιδ	ιε	δ	κζ μθ	ια	ιθ	ιγ ιε	κ μη	ς μβ	λθ	νβ
	α	ιε	ις	ε	ιβ ι	ιβ	κε	λβ	κβ γ	ζ μς	λς	νε
	β	ις	ιζ	ς	κε νε	ιγ	λα	ν	κγ ιη	η ν	λγ	ι νη
	γ	ιζ	ιη	ζ	θ νς	ιδ	λζ	ιδ ζ	κδ λγ	θ νδ	κθ	ια
	δ	ιη	ιθ	η	κγ με	ιε	μγ	κε	κε μζ	ι νη	κς	γ
	ε	ιθ	κ	θ νθ	ς μζ		ν	μβ	κζ α	ιβ β	κγ	ς
	ς	κ	κα	ι νη	ιθ νδ	ις	α νς	ιε	κη ιε	ιγ κδ	κ	θ
	ζ	κα	κβ	ια	β μβ		β β	ιζ	κθ κθ	ιδ μζ	ιζ	ιβ
ἀπόκρεα	α	κβ	κγ	ιβ	ιε λς	ιζ	η	λε	μγ	ις ια	ιδ	ιε
	β	κγ	κδ	ιγ	κη κς		ιε	να	α νζ	ιζ λε	ια	ιη
	γ	κδ	κε	ιδ	ι νε		κβ	ις η	γ ια	ιη νθ	η	κα
	δ	κε	κς	ιε νη	κβ μθ		λ	κα	δ κδ	κ λγ	δ	κγ
	ε	κς	κζ	ις νζ	δ λδ		λη	λγ	ε λη	κβ ς	ιε α	κς
	ς	κζ	κη	ιζ νζ	ις ιη		μς	μς	ς νβ	κγ λθ	ιδ νη	κθ
μάρτϊος	ζ	κη	α	ιη νς	κη ις	ιζ	β νδ	νη	η ς	κε ιβ	νε	λβ
τύρημ(α)[1]	α	κθ	β	ιθ νς	θ κε	ις	γ β	ιζ ια	θ κ	κς μς	νβ	λδ
σαπάν	β	α	γ	κ νε	κα μ	ιε	ι	κγ	ι λδ	κη κη	μη	λζ
	γ	β	δ	κα νε[2]	δ κ	ιδ	ιη	λς	ια μη	ι	με	μ
	δ	γ	ε	κβ νδ	ιζ	ιβ	κς	μη	ιγ β	α νβ	μβ	μγ
	ε	δ	ς	κγ νγ	κθ μγ	κ ια	γ λδ	ιη α	ιδ ις	γ λδ	ιδ λθ	ια μς

a αἱ ἡμέραι b ῥατζάπ c φεβρυάρϊος

1 MS τυρη$^{\mu\backslash}$ for τυρημα, *recte* τυρίνη.

2 νε superimposed on νδ.

f.171 MONTH 12

ὁδὸς ☾	♓ τὰ ζῴδια	♓ τὸν ♂	♓ τὸν ♃	♓ ☿	πρὸς ☍	πρὸς ☌	πρὸς ☋	♓ ☓	
	♈								
	♈	XX ε ℞							☌ △ τὸν ☍
ι[1] ♁	♉				− ι ℞	XX ια ℞	□ ς ♁	ὕψωμα ς ♁	στηρίζει ☋
	♉		− γ ℞						
ς ♁	♉	□ γ ♁		♉ ς ♁			△ β ℞		
	♊					□ ς ♁			☌ εἰς τὸν ☉
α ℞	♊	△ γ ℞							προποδισμός ☋
	♋		△ θ ℞		△ ε ♁	△ ε ℞			♂ □ ♃
β ℞	♋			XX η ♁			− ι ℞		
	♌		□ ι ℞		□ ς ♁				☌ △ ♈
β ℞	♌	− η ℞		□ ζ ♁					
	♍		XX ι ℞		XX[3] ζ ♁			− α ℞	
δ ℞	♍			△ ε ℞		− α ♁			
	♎						△ ς ♁		
ς ℞	♎							κκ ϟ ♁	
	♏	△ α ℞			♉ η ℞		□ ς ℞	τα ϟ ♁	
	♏		♉ ς ♁			△ ιβ ℞			☋ □ ☍
α ♁	♐			− δ ♁					☌ εἰς τὸν ♈
	♐	□ α ♁					XX ς ♁		στηριγμός ♈
α ℞[2]	♐					□ γ ℞			☌ XX τὸν ♃
	♑	XX α ℞			XX ς ℞				♂ εἰς τὸν ☉
ι ℞	♑		XX α ♁						
	♒			△ α ♁		XX ς ♁			♂ △ τὸν ☍
α ℞	♒		□ γ ℞		□ ς ♁				
α ℞	♒			□ δ ℞			♉ ϟ ♁		
	♓				△ θ ℞			♉ ς ℞[4]	♂ △ τὸν ♈
η ℞	♓	♉ δ ♁	△ β ♁						ἀναποδισμός ♈
	♈			XX γ ♁		♉ η ℞			☋ εἰς τὸν ♓
	♈								
ζ ♁	♈						XX ♈ ℞	ὕψωμα β ℞	☋ □ τὸν ♃

1 illegible ι inferred.
2 MS has ♀
3 XX superimposed on another symbol.
4 faint, ℞ inferred.

f.171[v]

MONTH 13

	a	b	c	♍	♎	♏	♐	♑	♒	♓	♈	♉
	ς	ις	ζ	κδ νγ	ιβ λγ	κ ι	γ μ	ιη ια	ιε κη	ε ιδ	ιγ μθ	ια μθ
	ζ	ιζ	η	κε νβ	κε νε	θ	μη	ιη	ις μα	ζ γ	μς	να
ὀρθοδοξία	α	ιη	θ	κς να	θ να	η	γ νς	κε	ιζ νδ	η νβ	μγ	νδ
	β	ιθ	ι	κζ ν	κγ[1]κβ	ζ	δ δ	λβ	ιθ ζ	ι μα	λθ	ια νζ
	γ	κ	ια	κη ν	ζ ια	ς	ιγ	μ	κ κ	ιβ λ	λς	ια νθ
σημείωσαι	δ	κα	ιβ	κθ μθ	κα κβ	κ δ	δ κβ	ιη μζ	κα λα	ιδ κ	ιγ λγ	ιβ

a αἱ ἡμέραι b σαπάν c μάρτιος

1 γ inferred

f.172 MONTH 13

a ☾	♓ τὰ ζῴδια	πρὸς τὸν ♃	♓ ☊	πρὸς τὸν ♅	♓ τὸν ☋	♓ ☿	♓ ♀	♓ ♇	
	♉		− ι ρ		− ς ρ				
1	♉	XX ς δ		♉ ς ρ					
	♊						□ ε δ		
1	♊	□ δ ρ				XX ϛ δ			
1	♋						Δ γ ρ		♇ εἰς τὸν ☉
ια ρ	♋	Δ ι ρ	Δ ε δ		Δ ϛ δ	□ ς δ			

a μετάβασις
1 illegible.

COMMENTARY

1. THE THEMATION

The tables of the Almanac are immediately preceded by a themation drawn up for the first day, AD 1336 Mar 12, Noon. The Byzantine and Hijra years are written just below. The positions of the Sun, Moon and planets agree almost exactly with the entries in the first row of the Almanac, as is seen from the following list.

Sun 0;0 (Almanac 0;4)
Moon 340<;9>
Saturn 218;1
Jupiter 36;4
Mars 16;35
Venus 340;59
Mercury 333;40 (Almanac 333;41)
Rising Node 3;40
Descending Node 183;40
Lot of Fortune (κλῆρος τύχης) Gemini
Lot of Daemon (κλῆρος δαίμονος[1]) Virgo 1;0
Year 6844, of the Arabs 737

The positions of the κλῆροι do not appear to agree with any of the schemes discussed by Bouché-Leclerq.

In the central panel there is a brief text, apparently a quotation from Galen, in a hand which differs from that of the rest of the Almanac, and certainly not forming an essential part of it. The text is as follows,

> From Galen,
> The order of the seasons is thus: the rising of the Pleiades is the beginning of Summer, the rising of the Dog (Sirius), the beginning of the second Summer or the after-season; Arcturos when rising makes the start of Autumn. Next the setting of the Pleiades is the beginning of Winter; finally the equinox after Winter is the beginning of Spring.
> Those who discovered the origins of the arts are as follows:

This continues in a long text, naming Euclid, and many others.

2 THE CALENDAR

The dates in the Almanac are given according to the Byzantine and Hijra calendars, and a number of Feasts in the Liturgical calendar are also noted. As will be seen the author was not entirely familiar with the system of Arabic months.

2.1 BYZANTINE

The Almanac supplies exact information about the Sun, Moon, and planets, from which the dates of the entries may be fixed beyond any doubt. Thus we know that the Almanac runs from 1336 Mar 12 to 1337 Mar 12, all the positions being calculated for Noon. On fol.160, just below the horoscope, the year is given in the lines

ἐν τοῖς ,$\overline{\varsigma\omega\mu\delta}$ (6844)
Ἀράβων $\overline{\psi\lambda\zeta}$ (737).

The year 6844 is calculated in the Byzantine World Era, which begins at A.D.-5507 Sept.1[2].

The names of the months are given in column 1, the Greek form of the Roman names being used in the Byzantine calendar. The Almanac notes also here the Paschal Term and certain Sundays in the Liturgical calendar, and the points at which new solar and lunar cycles begin, as well as the Indiction; Indiction 5 begins on 1 September 1337.

At the beginning of the Almanac the lunar cycle is the 4th, while the solar cycle is the 12th. The 5th year of the lunar cycle begins on 1 Jan. 1337, and so has been counted from 1 Jan. -5507. The 13th solar cycle begins on 1 Sep. 1337; year one began on 1 Sep. -5508. These data show a consistent use of the Byzantine Era set at 1 Sep -5508 (J.D. -290496)[3].

2.2 LITURGICAL

The liturgical dates noted in the Almanac are as follows.

	Byzantine	Latin	A.D.
X,13	ἡ βαϊοφόρος	Palm Sunday	24 March 1336
X,19	νομικὸν φασχὰ	Paschal Term	30 March 1336
X,22	χρόνος πασχὰ	Easter Sunday	31 March 1336
XII,19	ἀπόκρεα	Sexagesima	23 Feb. 1337
XII,26	τυρινή	Quinquagesima	2 March 1337
XIII,3	ὀρθοδοξία	First Sunday of Lent	9 March 1337

For details of the liturgical calendar, including the Paschal Term, Grumel should be consulted[4]. The octave of the Jewish Passover begins on 28 March, corresponding to 15 Nisan in that year (Jewish year 5096), as one may compute from the tables given by Mahler[5].

2.3 HIJRA

Greek transcriptions of all but two of the Arabic month names are given in column 1. According to the the Arabic calendar, the Almanac runs from A.H.736 Rajab 28 to A.H.737 Sha'bān 7. A.H.737 is a leap year, having 30 days in Dhū'l-Ḥijja. There are many errors in the Hijra dates: the first day is given as Rajab 29, and the last as Sha'bān 21; errors, moreover, were accumulated through the incorrect assignment of the lengths of the Hijra months, together with a sudden jump of 11 days at the start of the 13th month of the Almanac. Note also that IV,30 (163^{v}) and V,1 (164^{v}) are given as the first day of δελχήτζε (Dhū'l-Ḥijja). Only the interval Ramaḍān 1-29 happens to be in correct correspondence with the Latin calendar.

The Greek transcriptions of the month names are as follows.

μούχαραμ	Muḥarram
σαφὰρ	Ṣafar
ῥαπϊελάβελ	Rabī'l-awwal
ῥαπϊελάχηρ	Rabī'l-ākhir
τζηματϊλάβελ	Jumādā al-ūlā
τζηματϊλάχειρ	Jumādā al-ākhira
ῥατζάπ	Rajab
σαπάν	Sha'bān
ῥαμαδᾶν	Ramaḍān
σαουάλ	Shawwāl
δελχάτε	Dhū'l-Qa'da
δελχήτζε	Dhū'l-Ḥijja

3 ASTRONOMY

While the medieval Islamic zIj originated in the Handy Tables of Ptolemy, there were subsequently many developments in the way in which the mean longitudes and equations were tabulated. The two zIjes which were used by astronomers of Trebizond reveal a special feature, the use of 'displacements', which were introduced in order to largely eliminate rules which govern the addition and subtaction of the equation, since the 'displaced' equation is always positive. In the following the usual Ptolemaic theory is summarised, and then the system of displacements is explained. In the recalculation of the entries in the Almanac these analytical representations of the equations are used.

3.1 GRAPHICAL PRESENTATION OF THE ALMANAC

The several thousand entries which make up the tabulation of the longitudes of the Sun, the Moon and the planets require some efficient means of representation if their leading features are to be grasped. For this purpose these longitudes are plotted in a series of graphs, Figs.1-6[6]. These are taken directly from the tabulation in the Almanac. The Sun is not shown separately, but is shown in each of the other graphs, so as to make clear the luni-solar conjunctions and the planetary phases. In the lunar graph the short vertical segments marking the conjunctions are placed at the times given in the Almanac, column 16. In the planetary graphs the phases are annotated by numbers which refer to the phases as listed in section 5.6, and those points on the graphs are placed according to the times indicated in the Almanac, column 23.

3.2 TRUE LONGITUDES OF SUN, MOON AND PLANETS.

The true longitudes tabulated in the almanac are calculated from the Ptolemaic models of solar and planetary motion, and this would be the case whether they are derived from the Almagest, or from any of the Arabic zIjes available at the time. The derivation of the true longitude for each of these models results in a fairly complicated expression, which in the case of the Sun is a function of the solar anomaly alone, but in each of the other cases is a function of two variables, the so-called argument and centre. The Moon and the planets have a two-fold eccentricity depending on their positions relative to the Sun, and also to their own apogees.

Let the mean longitudes in all cases be denoted by L, the true longitude by λ, and the apogee by Γ, each with an appropriate suffix. The dimensions of the eccentricities will be S and M, which have fractional values relative to a

principle radius in the model taken as one.

Although the medieval tabulations follow Ptolemy's theoretical procedure, they are frequently based on a new choice of parameters, and so for any table it is essential to be able to derive the new underlying values of the eccentricity. The necessary formulae are included in the following summary of Ptolemy's theory.

SUN

The solar argument is $a = L_S - \Gamma_S$, and the solar equation is $-q(\kappa)$, where

$$\tan q(\kappa) = \frac{S \sin a}{1 + S \cos a}$$

$$\lambda_S = L_S - q(\kappa)$$

The maximum value of $q(\kappa)$ is $q_m = \arcsin(S)$, a relation which enables one to find the value of S from the maximum entry q_m in the table of the Sun's equation.

MOON

The three links constituting the model are respectively equal to M, 1-M, and S. The controlling angles are the double elongation $\kappa = 2(L_M - L_S)$, and the anomaly $a = L_M - \Gamma_M$.

The Moon's equation may then be written with the aid of two functions $q(\kappa)$, and $p(\theta,\kappa)$

$$\tan q(\kappa) = \frac{M \sin \kappa}{\sqrt{((1-M)^2 - (M \sin \kappa)^2)} + 2M \cos \kappa}$$

$$\tan p(\theta,\kappa) = \frac{S \sin \theta}{\sqrt{((1-M)^2 - (M \sin \kappa)^2)} + M \cos \kappa + S \cos \theta}$$

The longitude of the true Moon may then be written,

$$\lambda_M = L_M - p(a + q(\kappa), \kappa).$$

In some Islamic zījes one finds $p(\theta,180)$ tabulated for values of θ in the range 0,180, together with a tabulation of $p(\theta,0)$ for the range 180,360. From such tables we can determine the values of S and M. For the maximum value of $p(\theta,0)$ is then arcsin (S), and if N = M/(1-M), then the maximum of $q(\kappa)$, q_m, is given by

$$\tan q_m = N/\sqrt{((1-N^2)(1-4N^2))}$$

which can be solved as a quadratic equation for N^2, given the maximum value q_m. The value of κ at the maximum point is given by

$$\sin \kappa_m = \sqrt{((1-4N^2)/(1-4N^4))}.$$

OUTER PLANETS

The eccentricity of the planet's deferent is M, that of its epicycle S. The equation of the planet may be expressed concisely as

$$\tan \eta = \frac{S \sin \theta - (M/2)\sin \kappa - \sin \mu}{S \cos \theta + (M/2)\cos \kappa + \cos \mu}$$

where $\kappa = L_p - \Gamma_p$, $\theta = L_S - L_p$, $\sin \mu = (M/2)\sin \kappa$.

The variables κ, θ will be referred to as the centre and argument respectively. The equation of centre, or first equation, is

$$q(\kappa) = \arctan(M \sin \kappa / a(\kappa)),$$

where $a(\kappa) = \cos \mu + (M/2)\cos \kappa = \sqrt{(1-((M/2)\sin \kappa)^2)} + (M/2)\cos \kappa$.

The equation of argument, or second equation, is

$$\tan p(\varphi,\kappa) = \frac{S \sin \varphi}{a(\kappa)\sec q(\kappa) + S \cos \varphi}.$$

In terms of these functions p, q, the planet's equation is

$$\eta = p(\theta + q(\kappa), \kappa) - q(\kappa).$$

For the tabular arrangements, in terms of functions of one variable, a value of κ, κ_0, is chosen which is such that $a(\kappa_o)\sec q(\kappa_o) = 1$. The tabulation then gives $q(\kappa)$ and $p(\varphi,\kappa_0)$, and the values of S and M which were employed are determined by the maxima, q_m of $q(\kappa)$, and p_m of $p(\varphi,\kappa_0)$, respectively,

$$q_m = 2\arctan(M/2),$$
$$p_m = \arcsin(S).$$

VENUS

For the inner planet Venus we have only to interchange the Sun and the planet, within the model used for the outer planets,

$$\kappa = L_S - \Gamma_P,$$
$$\theta = L_P - L_S,$$
$$\lambda_P = L_S - \eta,$$

where η is given by the same expression as used for an outer planet.

MERCURY

The model of Mercury is complicated by an additional link, also of length M, but the effect, as far as the formulae are concerned, is to alter only the expression for $a(\kappa)$, the rest of the account for Venus then applying to this planet, the formulae for κ, θ and λ being the same as for Venus. The expression for $a(\kappa)$ is

$$a(\kappa) = M\cos\kappa + 2M\cos(\kappa/2)\cos(3\kappa/2) + \sqrt{(1-(2M\cos(\kappa/2)\cos(3\kappa/2))^2)}.$$

More direct computation is provided by the formula

$$\tan\eta = \frac{-2M\sin\kappa - M\sin(2\kappa) + \sin\mu + S\sin\theta}{2M\cos\kappa + M\cos(2\kappa) + \cos\mu + S\cos\theta}$$

where μ is defined above for the outer planets.

The values of S and M are obtained also by the formulae quoted for an outer planet. For the inner planets η is expressed in terms of p and q as above, defined for the outer planets.

EQUATION OF TIME

In the application of these calculations to astrology the true longitudes calculated for mean Noon had to be further corrected to give the positions at true Noon. The difference between these is the equation of time, the tabulation of which formed part of the regular collections of tables in the zījes, following example of the Handy Tables. In the Zīj-i Īlkhānī the resulting corrections for the Sun and Moon are tabulated separately, so eliminating the need to multiply the basic equation for time by the rate of motion of the Sun or Moon. These tables, and the actual use which Chrysococces made of them is discussed later in connection with the almanac for 1353 which is found in one copy of the Persian Syntaxis.

3.3 DISPLACED EQUATIONS

In the Zīj-i Īlkhānī, in the both the Persian and Greek versions, and in some other zījes, the equations which are tabulated are not exactly the functions p and q defined above, but instead certain modifications of them, which have the advantage of being positive throughout the range. When this is done there is no need of the rules governing the addition or subtraction of the values of the functions, rules which are needed because negative values are entirely absent in the mathematics of that time.

In the Zīj al-'Alā'i there is much less use of displaced equations, but other complications occur, which are given in detail below.

In the following the quantities used in the place of these defined above are denoted by primes. The displacement constants are α and β.

Zīj-i Īlkhānī

SUN

$$q'(\kappa) = \alpha - q(\kappa)$$
$$\Gamma'_S = \Gamma_S - \alpha$$
$$\lambda_S = L_S + \Gamma'_S + q'(\kappa)$$

MOON

$$a' = a - \alpha$$
$$L'_M = L_M - \beta$$
$$q'(\kappa) = \alpha + q(\kappa)$$
$$p'(a,\kappa) = \beta - p(a,\kappa)$$
$$\lambda_M = L'_M + p'(a' + q'(\kappa), \kappa)$$

As usual p′ is not tabulated directly as a function of two variables, but instead one finds that it is composed of two functions of one variable, depending on κ and a respectively. The function of a is the following,

$$p'_o(a) = \begin{cases} \beta - p(a,\pi), & 0 \le a \le 180 \\ \beta - p(a,0), & 180 \le a \le 360 \end{cases}$$

PLANETS

$$\kappa' = \kappa - \beta$$
$$\theta' = \theta + \alpha$$
$$q'(\kappa') = \alpha - q(\kappa)$$
$$p'(\theta',\kappa') = \beta - \alpha + p(\theta,\kappa)$$
$$\lambda = \kappa' + \Gamma + p'(\theta' - q'(\kappa'),\kappa') + q'(\kappa')$$

The various displacement constants are as follows

Planet	α	β
Sun:	2;0,30	-
Moon:	13;8	7;40
Saturn:	7;0	14;0
Jupiter:	6;0	18;0
Mars:	12;0	12;0
Venus:	2;0	2;0
Mercury:	4;0	4;0

Zīj al-'Alā'ī

SUN

A special form of the equation is tabulated which depends on a reference to the apogee Γ_{S_o} of the year A.Y.540 complete (JD 2149528, AD 1173 Feb 1). The equation is not 'displaced', but the arrangement in other respects is one peculiar to this handbook. The quantities tabulated are κ', Γ'_S and $q'(\kappa)$, defined as follows[7]. The final λ_S is of course equivalent to the usual expression. The Greek terminology is given after each set of equations[8].

$$\kappa' = L_S - \Gamma_S$$
$$\Gamma'_S = \Gamma_S - \Gamma_{S_o}$$
$$q'(\kappa') = \Gamma_{S_o} + \kappa' + q(\kappa')$$
$$\lambda = \kappa' + \Gamma' + q'(\kappa')$$

κ'	θεμέλιος τῆς μέσης κινήσεως τοῦ ἡλίου
Γ'_S	θεμέλιος τοῦ ὑψώματος τοῦ ἡλίου
$q'(\kappa')$	στερεὰ ὄρθωσις τοῦ ἡλίου
λ	αὐθημερινός

MOON

The displacement constants are $\alpha = 5;0$ and $\beta = 13;8$. The first equation uses as its argument the elongation of the displaced Moon L'_S from the Sun L_S, instead of the usual double elongation κ. The second equation is found as usual from tables of ancillary functions of one variable.

$$L'_M = L_M - \alpha$$
$$\kappa' = L'_M - L_S = \kappa/2 - \alpha$$
$$a' = a - \beta$$
$$q'(\kappa') = \beta + q(\kappa)$$
$$p'(a',\kappa) = \alpha - p(a,\kappa)$$
$$\lambda = L' + p'(a' + q'(\kappa'), \kappa')$$

L'_M	μέση κίνησις τῆς σελήνης
κ'	μετάβασις, <*or* κέντρον> τῆς σελήνης
a'	ἰδία κίνησις σελήνης
$q'(\kappa')$	πρώτη ὄρθωσις τῆς σελήνης
$p'(a',\kappa')$	δευτέρα ὄρθωσις τῆς σελήνης

PLANETS

The equations are not displaced, and the procedure is similar to that used for the Sun. In particular one uses the same table for the motion of the apogee $\Gamma'_P = \Gamma'_S$, since the planetary apogees move at the same rate as that of the Sun.

$$\kappa' = \kappa$$
$$\theta' = \theta$$
$$\Gamma'_P = \Gamma_P - \Gamma_{P_o}$$
$$q'(\kappa') = -q(\kappa)$$
$$p'(\theta',\kappa') = \Gamma_P + p(\theta,\kappa)$$
$$\lambda = \kappa' + p(\theta' - q(\kappa'), \kappa') + q(\kappa')$$

κ'	μέση κίνησις
θ'	ἰδία κίνησις
$q'(\kappa')$	πρώτη ὄρθωσις
$p'(\theta',\kappa')$	δευτέρα ὄρθωσις

4 SOURCES OF THE ALMANAC

A number of Arabic and Persian sources had come to be known in Greek by the time the Almanac was composed, and in the following calculations from these are compared with the entries in the Almanac. The problem is to determine not only which Islamic source, or sources, was used, but to to fix also the latitude and longitude assumed for Trebizond. As remarked in Sec. 3.1 the representation of the quantities tabulated in the Almanac in graphical form provides an efficient

means of surveying the problem and its solution.

4.1 ARABIC AND PERSIAN SOURCES

Although many Byzantine astronomical authors, such as Nicephoras Gregoras, depended on Ptolemy for all their calculations, one soon discovers that the Almagest or the Handy Tables could not have been the source for the present Almanac. Even a casual inspection of the solar positions shows this, because Ptolemaic positions for this date are some five degrees in error, while the positions in the Almanac are close to the true values. It is clear that the Almanac has been calculated from one of the Islamic sources available at that time, and the problem is to discover which one.

We may consider the following astronomical handbooks (zījes), which were either certainly known in Greek, or which may have been known in Greek.

Zīj al-'Adūdī (Arabic) of Ibn al-A'lam, ca.A.D.970

The first is known to have been used by Byzantine students of this subject in the twelfth century, the author being referred to as 'Αλὶμ. It can be reconstructed with some confidence from Greek, Arabic and Persian sources, even though the Zīj as such does not survive[9].

Zīj al-Sanjarī (Arabic) by al-Khāzinī, ca. A.D.1135

This was translated into Greek as Σύνταξις τοῦ Σαντζαρῆ, but neither the Arabic nor the Greek have been published[10].

Zīj al-'Alā'ī (Arabic) by al-Shirwānī, 12c

This is known through the Greek version, Σύνταξις τοῦ 'Αλαῆ, which it seems came via a Persian version. In any case the original Arabic and Persian sources have been lost, although extant Arabic tables use the same parameters[11].

Zīj-i Īlkhānī (Persian) by Naṣīr al-Dīn al-Ṭūsī, late 13c

This came to be known in Greek as the *Persian Syntaxis*, usually accompanied by a user's text written by George Chrysococces[12]. It came to be widely diffused in the Byzantine world after *ca* 1346.

Tāj al-Azyāj (Arabic) by al-Maghribī, late 13c
Adwār al-Anwār (Arabic) by al-Maghribī, late 13c.

These are by a contemporary of Naṣīr al-DIn, and are presumed to have been based also on work carried out at the observatory at Marāghah. While not known to have been translated into Greek, they will be here considered as possible sources[13].

The various mean parameters and equations of the five zIjes have been established from the appropriate manuscripts, and are all listed below in the section Parameters of zījes, which includes many hitherto unpublished results.

4.2 COMPARISON OF TRUE LONGITUDES

It is a straightforward matter to compute from any one of these sources the true longitudes of the Sun, Moon and planets, and so to make a comparison with the positions given in the Almanac. In carrying out such a comparison one must assume that in each case there has been a shift in the reference meridian through some difference in longitude that was assumed to exist between Trebizond and the prime meridian of the Zīj. The Ptolemaic longitude of Trebizond is 70;30, while other positions assigned in the various zījes are summarised in section 4.5

Let $\lambda_A(J)$ be the position provided in the Almanac for the 'planet' J (Sun, Moon and Node included) for any day, and $\lambda(J,\varphi)$ similarly that calculated from a possible source for the same day, when the meridian is shifted by an amount φ. The difference

$$\Delta(J,\varphi) = \lambda_A(J) - \lambda(J,\varphi)$$

averaged over the days in the almanac is calculated, and for each J a minimum of $|\Delta(J,\varphi)|$ is sought, as φ varies.

The variation of $\lambda(J,\varphi)$ with φ is proportional to the daily motion of the longitude, so that the Sun and Moon are the most useful to examine. In the following table the optimum meridians are shown for the Sun and Moon. These are shown for the the scale of longitude used in the zIj itself. In cases marked '-' there is no fit anywhere near a correct value.

Source	Reference Meridian		Sun	Moon
Zīj al-'Adūdī	Shīrāz	88	61	59
Zīj al-Sanjarī[a]	Merv	96	-	75
Zīj al-'Alā'i	Shirwān	84	-	79
Zīj-i Īlkhānī	Marāghah	82	71	59
Tāj al-Azyāj	Damascus	70	-	63
Adwār al-Anwār	Marāghah	82	86	62

Note a: This work expresses the meridian longitude on the scale of al-Khwārizmī, but these have been increased by 10;0 to allow easy comparison with the others.

For the Sun, only the Zīj-i Īlkhānī is best at a longitude convincingly near to the Ptolemaic longitude of Trebizond. For the Moon however none of the sources is very close to that longitude.

4.3 COMPARISON OF EQUATIONS

The equations of the Sun, Moon or planets are of course not immediately derivable from the entry in the almanac, because we do not know the mean longitude which was employed in their derivation. However if one subtracts from the entry in almanac the mean longitude provided by one of the zījes under consideration, one can then logically compare the resulting equation with the equation in the zīj itself, $\eta(J)$. If these agree closely, there is a strong if not absolutely conclusive argument in favour of that as the source. The difference between these two equations is again $\Delta(J,\varphi)$, since $L(J,\varphi)$ is subtracted from both terms,

$$\begin{aligned}\Delta(J,\varphi) &= \lambda_A(J) - L(J,\varphi) - (\lambda(J,\varphi) - L(J,\varphi)) \\ &= \eta_A(J) - \eta(J).\end{aligned}$$

These two equations, $\eta_A(J)$ and $\eta(J)$, will be plotted together. In this way we can see at once either the goodness of fit or the clear disagreement between the Almanac and the zīj. Figs 7, 8, 10-14, 16 show these equations for the Zīj-i Īlkhānī, calculated for a meridian 12;0 West of its reference meridian. It is clear that in most cases there is an impressively close agreement. One could not expect anything better in the cases of the Sun, Node, Mercury, Venus and Mars. These curves also show clearly the errors at particular dates in the Almanac, resulting either from the original calculations, or copyists' errors.

The equations calculated from the Zīj al-'Alā'i are shown in Figs. 23 - 30. Here the meridian has been shifted 4;0 to the West, as suggested by the search for

the optimum meridian. The results are closer than the Zīj-i Īlkhānī in the cases of the Moon and Jupiter, while there is no improvement for Saturn.

In the case of the Sun in the Zīj al-'Alā'ī there is a difference of some 0;40 between the equations $\eta_A(J)$ and $\eta(J)$, in contrast to the Zīj-i Īlkhānī. This arises essentially from the difference between the mean longitudes of the Sun in these two Zījes. It is interesting to note that just this difference is recognised in the Preface to the Zīj al-'Alā'ī[14],

> It is necessary to know that, if 40 minutes are subtracted from the true longitude of the Sun, the number for the solar eclipse is always found to be free from error. It is necessary to subtract 32 minutes from the true longitude of the Moon so that its number may be found to be correct. Because these minutes are to be subtracted the Zīj al-'Alā'ī is always equal to the Īlkhānī.

While the quantity 0;40 is confirmed by the mean longitudes of the Sun which we can calculate from these two works, the figure for the Moon appears to be 0;21, not 0;32. For example, on the first day of the Almanac the mean and true positions are as follows. This shows the differences 0;40 and 0;32 for the Sun and Moon respectively.

1336 Mar 12 (Tue) Noon

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
Zīj-i Īlkhānī (12;0 West)								
Mean	358; 4	344;55	209;34	40;43	18;14	188;37	260;30	3;41
True	0; 4	339;52	217;34	37; 9	16;15	339;47	333;35	3;41
Zīj al-'Alā'ī (4;0 West)								
Mean	358;45	345;16	209;34	39;32	18;38	189; 4	266; 7	3;39
True	0;44	340;13	217;30	35;57	16;27	340;18	334;32	3;39

It is clear from the Preface just quoted that people in the School of Trebizond, taking their lead no doubt from Persian mentors, were inclined to experiment somewhat with the parameters. With this hint, we might try various 'emendations' to the Zīj-i Īlkhānī in order to see whether a good fit can be found for the Moon, Jupiter and Saturn.

In the case of the Moon it is found, for example, that an increase of 0;40 in the mean longitude of the Moon produces an excellent fit, and it seems indeed that the calculator in this case has adopted a correction equal to the difference between the mean Solar longitudes of the two zījes.

If the equation of time had been taken into account it would show up in the positions of the Moon, but it would not be large enough to affect the positions of the Sun or the planets, when these are calculated to the nearest minute. There would appear to be a distinctly better fit when the equation of time is not included, especially when the conformity near the maxima and minima are studied, so we conclude on this evidence that this correction was not included by the almanac maker.

Trials with Jupiter and Saturn show that the following produce excellent agreements.

Jupiter:	decrease mean L_P and Apogee Γ_P by 1;20
	no change in mean Sun L_S, centre κ, or argument θ
Saturn:	decrease mean Sun L_S by 7;0
	no change in L_P, Γ_P, κ, or θ

The quantity 1;20 does not appear to relate to any other feature of the problem, nor to parameters of the Zīj al-Alā'ī. On the other hand the shift of 7;0 in the case of Saturn would appear to be directly related to the displacement constant of the displaced centre and equation of argument of Saturn in the Zīj-i Īlkhānī. For the mean centre is tabulated as $\delta - \Pi + \alpha$, where α, equal to 7;0, is the one of the displacement constants discussed in section 3.2 above. Of course if the rules had been followed precisely no error would have occurred at this point, but there have been enough indications so far of experimentation or 'improvement' on the part of the calculators, who were moreover in a position to compare these two zījes which use quite different systems of presentation.

The equations calculated for the Moon, Jupiter and Saturn, when these emendations are included are shown in Figs 9, 15, 17. The improvement which results is quite evident.

4.4 LENGTH OF DAY AND LATITUDE OF SITE

In column 13 the Almanac gives the length of day in hours. The length of day depends on the longitude of the Sun, the geographical latitude of the site, and also the obliquity of the ecliptic. We know the Sun's longitude according to col.5, and it may be calculated also from the Zīj-i Īlkhānī, as explained. The latitude of the site and the obliquity are however unknown. The calculator may have assumed the obliquity 23;30 used in the Zīj-i Īlkhānī, or may in fact have used the common value 23;35. As to the latitude, we can well surmise that the work was compiled for Trebizond, but even if that is true, we do not know which of the many medieval values of the latitude was used. According to the sources of the geographical coordinates, it may vary between 40 and 43 degrees, as one can see from the tabulation in section 4.5.

The length of day D, in hours, is given by

$$D = 12 + (24/180)\arcsin(\tan\delta \tan\varphi)$$

where δ is the Sun's declination and φ is the latitude of the site. The declination in turn is given by

$$\delta = \arcsin(\sin\lambda \sin\varepsilon)$$

where λ is the Sun's longitude and ε is the obliquity.

In the Zīj-i Īlkhānī the obliquity is taken as 23;30, but we must not assume that a Greek user would have taken that same value. I have discussed the problem elsewhere, pointing out that in the *Persian Syntaxis*, which appeared a little later *ca* 1346, the obliquity assumed in tables of declination, length of day and right ascension is 23;35.[15] It is entirely possible that the calculator of the Almanac also took the value 23;35.

As it turns out the obliquity cannot be firmly decided from an inspection of the length of day in col.13, and the analysis can only to isolate the correct values of φ. The obliquity will be taken, for the sake of argument as 23;35. In Figs 18, 19 each curve represents the difference between the tabulated value of D and that calculated from the above formulae using positions of the Sun provided by the Almanac (Fig.17), and the Zīj-i Īlkhānī (Fig.18). The six curves in each diagram represent the range of latitudes from 41 to 44 in steps of 0.5. The curve for the latitude 41 is uppermost in the left-hand half of the set, and

lowest in the right-hand half, the curves for the other latitudes in close succession between these limits.

In the case of an exact fit, the curve would be exactly zero. We ought therefore to look for the curve which is nearest to zero. In fact these curves are all quite irregular, because of the minute and random inaccuracies in the tabulated values of the day-length and the solar longitude in the Almanac. The defects in the values of the solar longitude in month II show up clearly. In Fig.18 the curves converge at either end to points near 0.1 hour, because of systematic rounding errors in the tabulated day length. As one would expect, those values are more consistent with the Sun in the Almanac than with the Sun in the Zīj. In any case one should naturally give greater weight to values near the maxima and minima of the day length curves, around days 90 and 270, when there is a greater sensitivity to variations of latitude. It is clear therefore that the curve for latitude 42 degrees is a better fit than the others, although 43 also gives a good fit over much of the range. This is the case whether one uses the Almanac, or the Zīj.

The curves in Figs. 20, 21 show D itself, both from the tabulated values, and those calculated for the latitude 42, and for the obliquity 23;35. On this scale the agreement is so close that the tabulated and calculated values are virtually indistinguishable.

The coordinates which have been used for the Almanac have been determined as longitude 70;0 on Ptolemy's scale, and latitude 42, or quite possibly 43. This position is essentially coincident with Ptolemy's coordinates, and this together with the considerations about the availability of the sources, discussed above in sec.4.5, suggests that this is what the author of the Almanac used.

4.5 THE POSITION OF TREBIZOND

The modern coordinates of Trebizond are 39;43 E, 41;0 N. The coordinates according to Ptolemy and the various Islamic sources are listed by Kennedy[16].

Longitude scale of Ptolemy

Long.	Lat.	
70;30	43;5	Ptolemy Handy Tables, Geography[17]
73;0	43;0	al-Battānī, al-Maghribī (Zīj), al-Kāshī, Ā'īn-i Akbarī, al-Dimyāṭī
76;0	40;0	al-Ṭūqānī

Longitude scale of al-Khwārizmī

Long.	Lat.	
64;30	47;0	al-Maghribī (K. Basṭ)
64;30	46;50	Abū'l-Fida' (quoting al-Maghribī)
63;0	48;0	Abū'l-Fidā' (quoting Kitāb al-Aṭwāl)
63;0	43;0	al-Baghdādī
56;0	40;0	al-Bīrūnī, al-Kāmilī, Ibn al-Shāṭir
56;0	30;0	al-Khāzinī

Of these sources, two are later than the Almanac: al-Kāshī, Ā'īn-i Akbārī, while the dates of al-Damyāṭī and al-Ṭūqānī are unknown. Of all these sources only Ptolemy is known with certainty to have been available to the calculator of the Almanac. Trebizond is not listed in the geographical tables of the zījes which are listed in section 4.2.

The geographical lists in the *Persian Syntaxis*, which is a Greek transcription of the Zīj-i Īlkhānī, vary from one manuscript to another. Sometimes a list of places is extracted from Ptolemy, for example, and in one case[18] we have the coordinates for Trebizond, given as 70;30, 43;5.

4.6 ERRORS IN THE ALMANAC

We must distinguish between errors made by the calculator and those made by the copyist. In order to demonstrate that the present manuscript is a copy we have only to consider the tabulation of the Sun and the Node.

SUN

Month II,1-30: the entries (apart from the sign) for days 1-8, 19-30 coincide with those on the same days in month III. Moreover on days 9-18 the number of degrees is just one less in Month II, the number of minutes being the same, except on day 14. The graphs which include the Sun, such as Fig.1, Fig.7, show that the error lies in Month II, and the copyist has made the mistake of copying into Month II the entries from the same days of Month III, while partly correcting himself. This is quite obviously a copyist's error, and so we can be sure that the copy of Almanac before us is not that written out by the original calculator.

Elsewhere too the error is evidently that of a copyist, as in Sun IX,1 where the entry νη should be κη.

In Figs.18 and 20 the errors in Month II and in IX,1 of the Sun show up, because the calculation of the graph makes use of the Sun as we find it, whereas if the calculator had used these positions of the Sun when finding the length of the day, the same errors would occur there as well, and would have cancelled out in the present graph.

These errors in the Sun's position are also not reflected in the times of conjunction with the Moon as given in col.16, which would have been the case if the calculator had been at fault.

NODE

Another error which is much more likely to have been committed by a copyist is evident in the tabulation of the Node, XIII 1-6, an error made when the copyist went from ιδ λθ at the end of one page (XII,30) to ιγ μθ, instead of ιδ λθ, at the start of the next, an error amounting to -0;50.

Numerous other errors seem to be those of the calculator. These are quite evident from the graphs of the equations in Figs.7 - 17, and require no comment, except to say that there is little likelihood of replicating them. The calculations of the Moon's positions were especially prone to error near the extremes of the equation, where the interpolation required more care. At the extremes of the equation of Mercury also irregularities are more evident near the extremes. One can perceive the use of linear interpolation over a stretch of 5 or 6 days.

4.7 THE SOLAR ECLIPSE OF 1337 MARCH 3.

An annular eclipse occurred on 1337 March 3 just within the period covered by the Almanac. Its details have been computed according to the programs given by Montenbruck (1989), supplemented by calculations of the position of the edge of the umbra. The central path is aligned SW to NE, and at its nearest point to Trebizond passes through the position long 42, lat 37;45 approximately, at 11;40 Mean Solar Time in Trebizond. On the central line the duration of annularity is from 9;40 to 12;40 Trebizond time. It is seen as annular, however, only within a path about 80 km on either side of the central line, so that at Trebizond, which lay some 300 km from the path of annularity, it would be seen as partial.

The editor of the predictions[19] wrongly supposed that the eclipse occurred in March of 1336, just before the start of the period covered by the almanac, and so commented,

> For this reason, he arranged the best predictions for each person, so they would please the populace. I suppose that they were composed by Libadenus between the 2nd and the 12th March 1336.

As already remarked, Libadenus was not the author. Morover the Almanac and the predictions were composed before the occurrence of the eclipse. Someone competent in the use of the eclipse tables in the handbooks of the time might have derived a prediction, but this was not done by the author of this almanac.

In the Chronicle of Trebizond written by Michael Panaretos, the eclipse is noted for the Byzantine year 6845. This was remarked by the editor in the CCAG, who had however only the edition of Fallmerayer (1844) at his disposal. Since then this Chronicle, which is known from the unique extant copy in St.Mark's Library, Venice, manuscript 608, and which is the unique source for the history of Trebizond in that period, has been edited by Lambros (1907), Paboukhi (1947), and Lampsides (1958a,b). The passage is as follows[20],

> Μηνὶ Μαρτίῳ γ', ἡμέρᾳ β' τῆς ἀρχινηστίμου τῆς ἁγίας μ', ἐγένετο ἔκλειψις τοῦ ἡλίου ἀπὸ ὥρας δ' ἕως ὥρας ζ' καὶ ἐταράχθη τὸ κοινὸν κατὰ τοῦ βασιλέως, ὥστε καὶ ἔξωθεν τοῦ κουλᾶ συναχθέντες λίθους ἔσυραν εἰς αὐτόν, ἔτους ,ϛωμε'.

which may be rendered,

> On the third day of March, second day <Monday>, of the first week of Lent, an eclipse of the Sun occurred from the 4th to the 7th hour; the populace rose against the Emperor, and gathering outside the castle, attacked it with stones; the year 6845.

The editor in the CCAG, who had evidently not checked the astronomical facts, erred in taking the year as 1336 instead of 1337, even though according to the usual rule[21] the Byzantine year 6845 runs from 1336 1 Sep to 1337 Aug 31.[22]

Fallmerayer wrongly rendered the opening as "Im Monat März den zweiten Tag der grossen heiligen vierzigtägigen Fasten...". The second β' refers to Monday, not 'second day of Lent'; the first Monday in Lent in that year is the 3rd of March. The day of the month is given as β' in the manuscript, but as Lampsides explains[23], must be corrected to γ'; this was not noticed by earlier editors, including the CCAG.

The duration of annularity from 9;40 to 12;40 after midnight is equivalent to the interval 3;40 to 6;40 hours of the day, and so agrees entirely with the duration given in the text, '4th to the 7th hour'.

5 THE ASTROLOGY

This section concerns the columns of the right hand pages, which give information of direct interest to astrological applications of the Almanac. In the following sections we give the background to columns 14-23, which tabulate the passage of the Moon through the signs of the ecliptic, its configurations with respect to the sun, planets and Node, and its exaltations and depressions.

Sections 5.6 and 5.7 concern column 23, which includes the exaltations and depressions of the Sun and planets, as well as the phases of the planets.

5.1 PASSAGE OF THE MOON THROUGH THE SIGNS

Columns 14, 15 record the passage of the Moon through the signs. The sign in which the Moon is situated at Noon is given in column 15. In column 14 the almanac gives the time when the Moon made the transition between the signs indicated in the adjacent entries in column 15.

In line I,2, for example, ε ♌ indicates that the Moon passed from ♐ to ♈ in the fifth hour of the night following Noon of the second day. The hours given in this and the later columns run uniformly, so that the day-night is divided into 24 equal hours, but they are reckoned not from Noon or Midnight, but from the beginning of the prevailing day or night. It may happen therefore that the number of hours exceeds 12, in either night or day, as we see in lines II,9,17 III,9 IV,23 V,3,20 IX,3,10 X,4,5,20 XI,13.

In order to determine the moment when the Moon enters a new sign one may imagine various procedures to have been used by the calculator, since there is the question as to whether he used the true lunar motion when interpolating between Noon positions, or simply assumed a uniform motion of the Moon. For example a simple procedure is given in the text accompanying the Greek version of the Zīj al-'Alā'ī[24]. There the motion of the Moon is not calculated from the true position at Noon, but is taken simply to move at the constant rate of 0;30 per hour (12;0 per day). Since the correct mean motion is about 13.176... per day, this is not even a close approximation to the mean motion. Within this

assumption, two procedures are given according to whether the Moon at Noon is placed just before the transition to the next sign, or just after it.

It is not difficult to investigate whether this method or the more exact one which makes use of the true positions at Noon has been used in the Almanac, and to discover that the latter is the case. The detailed determination of the time is as follows. If at Noon on the n^{th} day the Moon has completed k Zodiacal signs, then let T(k,n) be the number of hours which have elapsed since that completion. The expression for T(k,n) is

$$T(k,n) = 24(L(n)-30k)/M(n),$$

where L(n) = Moon's longitude at Noon on the n^{th} day, measured from the beginning of ♈

M(n) = L(n+1)-L(n), the Moon's daily motion.

The values of L(n) are taken from Col.6. Let D(n) be the duration of daylight on the n^{th} day, as recorded in Col.13. Then if T(k,n) lies between -D(n)/2 and 24-D(n)/2, an entry is made in the Almanac for the n^{th} day. If T(k,n) lies between -D(n)/2 and D(n)/2 it is marked 'day', ☉, otherwise 'night', ☾.

5.2 LUNAR PHASES WITH SUN AND PLANETS

For the remaining columns we need the elongation of the Moon from the Sun, the planet, or the Node; let any one of them have the longitude P(n), then the elongation E(n) is E(n) = L(n)-P(n). The daily increment is M(n) = E(n+1)-E(n). Let the configuration be represented by a quantity S(k) which takes the values

60, 90, 120, 180, 240, 270, 300, 360.

The time relative to Noon of the n^{th} day, when the configuration S(k) is attained, is T(k,n) hours, where

$$T(k,n) = 24(E(n)-S(k))/M(n),$$

E(n) being measured from the start of Aries. An entry is required if T(k,n) lies between -D(n)/2 and 24-D(n)/2. The whole procedure is very much the same as with the determination of the passage of the Moon through the signs. In the case of the Node, only the conjunction and opposition are recorded in the Almanac.

5.3 EXALTATION AND DEPRESSION OF THE MOON

In column 22, along with the configurations of the Moon with its Node, we are also given the times when the Moon reaches its points of exaltation and depression. In classical astrology, the longitudes of these points are 63 and 213 degrees respectively. The Almanac records also a quantity noted only through the abbreviation κκ. The meaning is not absolutely clear but may represent καρόκερκος, 'head and tail'. In a passage published in the CCAG[25], on the properties of a solar eclipse, we read

ὅ δὲ μέγας ἐν τῇ ἀστρολογίᾳ Ἄμμων ἔν τισι τῶν αὐτοῦ· σχολαίαν, φησί, ἐν γ' τῶν ζωνῶν πορείαν ‹ποιῶν› ἀναμεταξὺ Ἡλίου τε καὶ Σελήνης ἐστὶν ἀστὴρ Ἀρκτοῦρος ὀνομαζόμενος, παρά τισι δὲ Ὕδρα, παρὰ δὲ ἑτέροις Καρόκερκος, ὅ ἐστὶν κεφαλὴ καὶ οὐρά. ὅ γὰρ τοιοῦτος φύσει πέλει ἐκτάδιος καὶ λίαν ἠμαυρωμένος ἐστίν· καὶ ἀνακυκλουμένων ἐτῶν $\overline{οζ}$ συνοδοιπορεῖ τῷ Ἡλίῳ, κἂν ἐν τῇ αὐτῇ μοίρᾳ ᾖ, ἔνθεν ἀποσβέννυσι τὰς αὐγάς, καὶ ἡ μελανότης τοῦ σκοτεινωτάτου ἀστέρος ὡς οἷα φραγμὸς κωλύει τὰς ἡλιακὰς λαμπηδόνας ἀφ' ἡμῶν ἐνορᾶσθαι.

> Ammon great in astrology, in something of his: travelling slowly in the 3rd zone between Sun and Moon, he says, there is a star named Arktouros, but by some Hydra, and Karokerkos by others, that is the head and tail. Such a one came to be extended by nature and is very darkening; and encircling in 77 years it travels together with the Sun, and if it is in the same degree, then it extinguishes the light of the Sun, and the darkness of the darkest star, as a kind of blocking up prevents the solar brightness from being observed by us.

There is similarity to the Persian pseudo-planet Kaid, which has a period of 144 years. Tables of Kaid are included in the Zīj-i Īlkhānī, and in the Zīj al-'Alā'ī[26].

In any case, with one exception, the depression is always placed exactly 24 hours later than 'κκ', so that the Moon's position is 213 less the daily motion, that is essentially 200 degrees. In the calculated version of the Almanac, it is assumed that 'κκ' occurs when the Moon's longitude is 200, and that the exaltation and depression are at the classical positions. The corresponding times in the Almanac do not generally differ from this calculation by more than two hours. The exception just mentioned occurs at I,22 when the depression is at 7 hours, while the preceding 'κκ' is at 6 hours.

5.4 ACCURACY OF THE LUNAR CONFIGURATIONS IN THE ALMANAC.

The entries in cols.14-22 have been calculated from the relevant columns of the left hand pages. The errors in the times which mark the Moon's progress through the signs do not often exceed two hours, which represents about one degree of the Moon's motion. There are however many errors in the zodiacal symbols, far more than would be accounted for by a careless scribe, but as if the calculator were not sure whether he meant to indicate the beginning of the sign or its completion. The times of the other configurations are rather less accurate, with errors of several hours being not uncommon. In a few cases one finds errors of configuration symbols, or a permutation between 'day' and 'night', or perhaps an omission of the whole entry.

5.5 EXALTATION AND DEPRESSION OF THE SUN AND PLANETS.

Like the Moon, the Sun and planets have assigned to them a series of diametrically opposed points in the ecliptic, their exaltations and depressions; these are given in column 23 of the Almanac. As in the case of the Moon, they have no astronomical significance that anyone has ever discovered. The classical values are given by Bouché-Leclercq[27], as follows.

	EXALTATION	DEPRESSION
SUN	19	199
MOON	63	213
MERCURY	165	345
VENUS	357	177
MARS	298	118
JUPITER	105	285
SATURN	201	21

Some of these have been omitted from the Almanac, because of the limited range of the planetary longitudes covered during the course of the year, but others are omitted in error. Those appropriate to the Almanac are listed in the following table, including the two that were omitted, marked < >. The outliers are marked *. The longitudes given are the values at Noon according to the Almanac.

	EXALTATION		DEPRESSION	
SUN	I,20	18;39	<VII,27	199;13>
MERCURY	VI,9	165;41	I,8	344;17
VENUS	II,13	356;52	VII,22	175;55
MARS	*		< V,28	117;44>
JUPITER	*		*	
SATURN	*		*	

The Moon is discussed in Sec. 5.4.

5.6 THE PHASES OF THE PLANETS

In the column 23 (of the right hand pages), the Almanac gives the phases of all the planets. The phases indicate the planet's synodic behaviour, which is more immediately relevant to direct observation, of course, than the planet's longitude in the ecliptic. These stages of its synodic progress are referred to by Greek technical terms, although those used in the Almanac differ somewhat from those familiar from ancient texts, such as one may find in the classic account of Bouché-Leclercq[28]. In the Table of Phases which follows, where naturally the inner and outer planets are treated separately, all the terms which occur in the Almanac are listed. To be exact, one of the terms given, ἀκρόνυχος (the opposition of the outer planet), is not used in the Almanac, although it should have been noted for Jupiter on IX,12, and for Saturn on II,8. The reference numbers of the phases in this table are used to mark the corresponding points on the graphs of the planets' longitude, Figs 2 - 6. In these graphs, the Sun is also plotted, so that one can interpret the phases easily, in terms of the motion of the planet in relation to the Sun.

TABLE OF PHASES

Inner planets

1. καῦμα II,4 IV,3 V,24 VII,28 IX,25 X,6 XI,19
   true conjunction (I)

2. φάνει εἰς ἀνατολὴν
   φαίνεται εἰς ἀνατολὴν IV,12 VIII,5
   φάσις ἑῴα XI,24
   rises in East just before Sunrise

3. στηριγμός I,1
   στηρίζει XII,3
   longitude stationary (I), less than Sun's longitude;
   planet seen in East; followed by προποδισμός

4. προποδισμός I,11 IV,11 VIII,9 XII,7
   advance begins; planet visible in East;
   follows stationary (I)

5. δύνει ἀνατολή V,9
   δύσις ἑῴα IX,5,9
   disappears in East just before Sunrise

6. καῦμα
   apparent conjunction (II)

7. φάνει δυτικά II,22 VI,17
   φάσις δυτική XI,2
   φάσις ἑσπέριος X,17
   appears in West just before Sunset

8. δύνει δυτικά III,26
   δύσις δυτική XI,10
   disappears in West just after Sunset

9. στηριγμός XI,13
   longitude stationary (II), greater than Sun's longitude;
   planet seen in West; followed by ἀναποδισμός

10. ἀναποδισμός III,21 VII,18 XI,15
retrogradation begins; planet visible in West;
follows stationary (II)

Outer planets

1. καῦμα II,17 III,6 VIII,17
conjunction

2. φαίνεται III,16 IV,27 VIII,29
rises in East just before Sunrise

3. στηριγμός XII,19
stationary (I)

4. ἀναποδισμός VII,12 XII,27
retrogradation begins

5. ἀκρόνυχος not in Almanac
opposition to Sun

6. στηριγμὸς IV,21 XI,7
stationary (II)

7. προποδισμός V,1 XI,11
advance begins

8. δύνη I,15 VII,29
ἔδυνε II,5
sets in West just after Sunset

5.7 RISING AND SETTING

In the next table the risings and settings of the planets are listed, at the dates taken from the Almanac. The figure after each date is the distance of the planet from the Sun at Noon, positive when the planet has the greater longitude. There are two instances omitted from the Almanac, both for Mercury, conjecturally restored, and marked by < >.

TABLE OF DATES AND ELONGATIONS OF RISING AND SETTING

	rises (E)		sets (E)		rises (W)		sets (W)	
MERCURY			<I,21	-12.3>	II,22	16.7	III,26	12.5
	IV,12	-15.2	V,9	-12.5	VI,17	17.5	<VII,20	12.2>
	VIII,5	-9.6	IX,5	-14.2	X,18	15.4	XI,10	14.2
	XI,24	-10.6						
VENUS	IX,9	-6.4	XI,2	6.4				
MARS							I,15	12.8
	IV,27	-13.9						
JUPITER							II,5	11.6
	III,16	-19.3						
SATURN							VII,29	16.7
	VIII,29	-9.9						

The rising and setting of a planet depends on its emerging in the twilight, before the rising Sun, or after the setting Sun, and is therefore a function of the distance of the Sun below the horizon, and the brightness of the planet, as well as some personal equation of the observer. One can see from the above table that the risings and settings given in the Almanac are not just a simple function of the elongation from the Sun. Only in the case of Venus are the elongations the same in the two instances noted, while in the case of Mercury, they vary between 9.6 and 17.5 degrees.

5.8 CONJUNCTION AND OPPOSITION

For the inner planets true and apparent conjunction are distinguished; at true conjunction the heliocentric longitudes of the planet and the earth are equal, that is the planet is situated between the Sun and the earth. When the heliocentric longitudes differ by 180 there is apparent conjunction for the inner planet, and opposition for the outer planet. In the following table the conjunctions and oppositions are listed, according to the Almanac. The figure after each date is the distance of the planet from the Sun at Noon, positive when the planet has the greater longitude. No oppositions of the outer planets are given, although they should have been given for Jupiter and Saturn, whose oppositions occur during the period of the Almanac.

TABLE OF CONJUNCTIONS AND OPPOSITIONS

	true conjunction		apparent conjunction	
MERCURY			II,4	0.6
	IV,3	-0.8	V,24	-0.3
	VII,28	-0.2	IX,25	-0.4
	XI,19	1.0		
VENUS			X,6	-0.1

	conjunction		opposition	
MARS	III,6	0.3		
JUPITER	II,17	1.9	<IX,12	-179.7>
SATURN			<II,8	-179.4>
	VII,17	0.8		

5.9 STATIONARY POINTS

In the simple mathematical sense, a planet is at its unique stationary point when its geocentric longitude reaches an instantaneous maximum or minimum. In practice the description of this phase, the στηριγμός, is complicated by the introduction of the ἀναποδισμός and προποδισμός. Προποδισμός ('beginning of advance') marks the point in the planet's path when its longitude begins to increase, following the stationary point at which it is a minimum, whereas the ἀναποδισμός ('beginning of retrogradation') follows after the maximum. From the graphs of the individual planets one can see that in these examples any one of these three points might be omitted by the calculator.

MERCURY

We can examine three cycles of the phase. The στηριγμός is given only for the maximum and minimum of the third of these cycles, but the ἀνα- and προποδισμός are given in every cycle. The longitude in the neighbourhood of the stationary point does not vary smoothly but, as actually calculated, is almost constant for some days, after which the rate of increase or decrease changes abruptly.The στηριγμός is placed mid-way in the constant range, while the ἀνα- and προποδισμός comes at its end.

VENUS

The στηριγμός occurs on the first day of the Almanac I,1, after which the longitude continues to decrease very slowly, at the constant rate of 0;4 per day, until it reaches 340;20, marked as the προποδισμός, and then begins a rapid increase.

MARS

Within the period covered by the Almanac, Mars shows no stationary behaviour, only setting, conjunction and rising, already covered above.

JUPITER

The στηριγμός, which is not listed, should be put at the dates VII,10 or VII,11 when the longitude is at the maximum value 69;55. The ἀναποδισμός is put on the next day VII,12, when the longitude is 69;54.

SATURN

From IV,20 to IV,30 the longitude at its minimum is constant and equal to 211;29. The στηριγμός put at IV,21, while the προποδισμός is at V,1, when the longitude begins its increase with the value 211;30.

5.10 PASSAGE OF THE PLANETS THROUGH THE SIGNS

In col.23 one finds besides the planetary phases already discussed, all the notices of planetary entry into the successive zodiacal signs, and also notices of the various configurations among Sun, planets and Node.

TABLE OF ENTRIES INTO THE SIGNS

	Mercury	Venus	Mars	Jupiter	Saturn
Ari	I,17	II,16; XII,18			-
Tau	II,3	III,18	I,21	XI,4	
Gem	II,19; IV,2	IV,15	II,2	IV,16; XI,18	
Can	III, 9; IV,24	<V,11>	<IV,15>		
Leo	V,14	VI,7	<VI,2>		
Vir	VI,2	VII,1	<VII,19>		
Lib	VI,18	VII,25	IX,11		
Sco	VIII,25	VIII,18	XI,9		
Sag	IX,15	IX,13			
Cap	X,2	X,7			
Aqu	X,19	XI,1			
Pis	XII,28	XI,21			

COMMENT. These notices mark the entry into the sign, not the completion of the sign, as was the case with the Moon. However, the calculator has erred in the notice for IV,2, for Mercury then has the longitude 90, not 60. In fact, during its motion through two stationary points it crosses the boundary of Cancer three times. In the case of Venus the entry into Cancer was overlooked, and two other notices should be corrected: VIII,18 should be VIII,19, and XI,21 should be XI,24. For Mars three entries were overlooked, given in brackets < >. For Jupiter, IV,16 should be IV,17. Saturn is not listed among these notices, which is correct, because within the year of the Almanac, it moves only within the sign Scorpio, without crossing the boundary.

5.11 CONFIGURATIONS AMONGST THE PLANETS

In the following tables the details are taken from the text, column 23, with omissions indicated by < >. The same symbols are used for the various configurations.

Mercury with:

Venus	Mars	Jupiter	Saturn	Node
I,6 ☌	II,12 ☌	I,4 ⚹[c]	I,3 △[e]	I,18 ☌
II,21 ⚹	IV,7 ☌	II,11 ☌	II,6 –	<VI,15 –>
III,23 ⚹	V,4 ☌	V,17 ⚹	III,12,28 △[f]	XIII,5 ☌[g]
VIII,10 ☌[a]	VII,6 ⚹	VI,5 □	IV,26 △	
IX,21 ☌	VII,10 ⚹	VI,25 △	V,15 □	
XI,14 ☌	IX,17 ⚹	IX,18 –	VI,3 ⚹	
	X,13 □	X,19 △[d]	IX,3 ☌	
	XII,17 □[b]	XII,30 □	X,11 ⚹	
			XI,12 □	
			<XII,22 □>	

a:9 b:18 c:3 d:20 e:4 g:6

Venus with:

Mars	Jupiter	Saturn	Node
VI,11 ☌	I,14 ⚹[b]	III,20 –	II,18 ☌
IX,14 ⚹	IV,14 ☌	V,12 △	VII,19 –[d]
X,12 □	VI,13 ⚹	VI,8 □	XII,6 ☌
X,25 □[a]	VII,9 □	VII,5 ⚹	
XII, 2 △	VIII,2 △	VIII,28 ☌	
	IX,16 –	X,20 ⚹	
	X,30 △	XI,16 □	
	XI,22 □[c]	XII,10 △	
	XII,20 ⚹		

a:26 b:Venus-Jupiter elongation has a minimum near 302
c:24 d:20

Mars with:

Jupiter	Saturn	Node
II,9 ☌	I,30 –	VIII,24 –[a]
<VI,15 ⚹>	IV,17 △	
<VIII,5 □>	VI,6 □	
<IX,18 △>	VIII,3 ⚹	

a:25

Jupiter with:

Saturn	Node
I,12 –[a]	

a:9

Sun with:

Mars	Jupiter	Saturn	Node
<III,7 ☌>	<II,21 ☌>	II,7 –[a]	I,5 ☌
IX,4 ☍	V,10 ☍	IV,6 △	VII,2 –
XI,5 □	VI,16 □	V,7 □	XII,21 ☌
XII,23 △	VII,17 △	VI,10 ☍	
	IX,12 –	<VIII,18 ☌>	
	XI,6 △	X,24 ☍	
	XII,8 □	XI,23 □[b]	
		XII,26 △	

a:8 b:26

COMMENT. The set of configurations is nearly complete, the major omissions being the three between Mars and Jupiter. An examination of the dates shows that while a number are in error by one day, only three cases are worse than that. The only configurations in which the Node figures are ☌ and –. No configurations between the Sun and the inner planets are given, for of course their elongations never exceed 45 degrees, and the conjunctions are included among their phases, in sec.5.3.

6. THE QUESTION OF AUTHORSHIP

The Almanac is anonymous, and we have seen that Libadenus cannot be the author. The following discussion is based on the simple assumption that one author is alone responsible for both the almanac and the predictions which accompany it, but nevertheless it is quite possible that these had two different authors. The sources, the Zīj-i Īlkhānī and perhaps the Zīj al'Alā'i, are associated with the names of Gregory Chioniades, the priest Manuel, and George Chrysococces. Of these only Manuel would seem to have flourished at the right time, *ca* 1336. We do not know just when Chioniades died, but his activity must have come to end in the first decade of the century. Chrysococces composed his own Syntaxis around 1346, as we know from the dates which he used in his examples. Manuel was situated between these two figures, and as is well known, transmitted Chioniades' translation of the Zīj-i Īlkhānī, when teaching Chrysococces. In the latter's own words addressed to his brother, with which he begins his work[29],

> In the past, I myself, as you know dear John, being concerned to get to know the Persian Handy Tables, made use of a certain priest from Trebizond named Manuel; you met with me frequently, and enjoyed <our>

> words, and not content to be far from understanding them, you fastened yourself to the study. You encouraged me to expound the instruction systematically by examples, and - hear me! - to illustrate their simple methods, and to recall as much as possible the words of the master. So the first thing which ought to be recalled from this is how this same Syntaxis was brought from Persia and translated by someone into Greek. Then that one <Manuel> related how a certain Chioniades, educated in Constantinople, and learned in all parts of mathematics, fell in love with the language of another science,...

While it has been commonly assumed that the teaching which Chrysococces received from Manuel took place in Trebizond, one should note carefully that in the above passage Chrysococces only states that Manuel was *from* Trebizond, without indicating just where the teaching took place. This point should be kept in mind in the following discussion.

Towards the end of the Syntaxis[30], Chrysococces refers again to his old teacher,

ἐπειδὴ κατὰ τιν'ἀγαθὴν τύχην καὶ αὐτὸς τὰ τῆς ἰατρικῆς παιδευόμενος, τοῖς τούτων συγγράμμασιν ἐντυχὼν, καὶ ἰδὼν ὅσον εἰς ἰατρικὴν τὸ χρήσιμον ἐκ τῆς καταλήψεως τῶν πλανωμένων κινήσεως, παρὰ μὲν τῷ Τραπεζουντίῳ ἐκείνῳ ἱερεῖ τῷ ἡμῶν διδασκάλῳ, σπεύσας, ὥσπερ οἶσθα, μεμάθηκα·

> since by good fortune I have myself studied medecine, having consulted their treatises and since having seen at what point it useful for medecine to understand the motion of the planets, I have studied eagerly, as you [John] know, with this priest at Trebizond, my master; in obedience to you, I remembered as much as was possible, thanks to some systematic notes, of the teachings of my master.

Further in the same chapter of the Syntaxis, Chrysococces indicates how one should prepare such an Almanac as we have here, and he says clearly enough that Manuel had composed one for a complete year.[31]

Εἰ γάρ τις ἐκ τῆς Συντάξεως ταύτης ἐφημερίδας τοῦ ὅλου ἐνιαυτοῦ ἐκβάλλει ὡς ὁ ἡμῶν ἐποίει διδάσκαλος, καὶ σπεύσει γινώσκειν τὰς ὑπὸ τοῦ θεοῦ δεδομένας δυνάμεις τοῖς ἄστροις, τουτέστι, τὰς κράσεις καὶ ποιοτήτας καὶ τὰς δηλώσεις πάντων ὧν ἐν τῇ τοῦ θεματίου ἐκθέσει ἐμνημονεύσαμεν, τοῖς πᾶσιν ἔσται θαυμαστός, ἐκ τῆς τῶν ὄντων τε καὶ μελλόντων προρρήσεως, ὥσπερ καὶ ὁ ἡμῶν ἐκεῖνος διδάσκαλος· οἶσθα γὰρ οἶσθα ὁποῖον ἐν τούτοις τὸ κράτος εἶχε·

προδιδάσκων γὰρ ἀεὶ καὶ προλέγων τά τε ὄντα καὶ μέλλοντα, ποτὲ δὲ καὶ τὰ παρελθόντα, θαυμαστὸς τοῖς πᾶσιν ἐδόκει, καὶ πέρα φύσεως ἀνθρωπίνης· μετὰ γὰρ τὴν τῆς ψηφηφορίας πολλὴν ἀσχολίαν εἰ οὐδέν τι τούτων γινώσκει τις ἀλλ'ἐποχὰς μόνας ἀστέρων ἡ γνῶσις τούτου ἀνὰ σκότος καλινδουμένη, νωθρὰ γηράσκει· τούτου χάριν, σκοπὸν ἐθέμην πραγματείαν συντάξαι ἐν τετράσι βιβλίοις εἰς τρία τμήματα τούτων ἕκαστον μεριζόμενον· περιέχουσαν τὰ δηλούμενα ὑπὸ τε τῶν ζῳδίων αὐτῶν, καὶ τῆς τῶν πλανωμένων τὲ καὶ ἀπλανῶν κινήσεως, οὐ πᾶσαν οἰκοθεν ἐργασόμενος, ἀλλ'ἐκ Περσῶν μὲν ἔχων ὅσα παρὰ τοῦ ἡμῶν διδασκάλου βαρβάρως ἐξελληνίσθησαν, εἰ καί τινα ῥυθμὸν Ἑλληνικὸν πολλὰ μοχθήσας τούτοις ἐνέθηκα, τὰ πλείω δὲ καὶ ἐκ τῶν Ἑλληνικῶν βιβλίων ληψόμενος·

> If anyone with the aid of this Syntaxis establishes ephemerides for the complete year as did our teacher, and strives to know the powers given by God to the stars, that is temperaments, qualities, and interpretations of all that we have called to mind in the exposition of the themation, he will be admired, both for the predictions of both present and future, and also just like our teacher. You [John] know, you know indeed what competence he had in these matters; for being always instructed in advance and predicting the present and the future as well sometimes the past, he [appeared] to everyone as someone extraordinary and beyond human nature; so if someone who lacked the great time needed for the calculation knew nothing of this [discipline] but knew only the positions of the stars, his knowledge wallowing in uncertainty would grow old and sluggish. For this reason I settled on the aim of arranging the matter to be studied into four books, each in three sections, which includes what is predicted about the zodiacal signs themselves by the movements of the planets and the stars without having done the work entirely by myself, but according to the Persians, making use on the one hand of all that has been translated into Greek, into poor Greek, by our Professor - even when with much trouble I have inserted measured Greek - while having, on the other hand, taken the greatest part from Greek works.

Since it is established that Manuel composed, in Trebizond, an Almanac for a whole year, we have a very strong argument, if not a complete proof that the present Almanac for 1336/7 is that work, so that Manuel is its author. This passage also shows that Manuel, for all his expertise in Persian astronomy, was not well enough educated to write Greek with some style.

Another side to the discussion arises from the fact another Manuel, Manuel

Bryennius, was active in Constantinople somewhat earlier as the teacher of Theodore Metochites (1270 - 1332)[32]. He was an enigmatic figure, an 'original', who was taken in as a member of Metochites' household as a teacher of mathematical science. It appears that he was low-born, and very much Metochites' social inferior. This episode is described by Metochites himself in two of his works, his Elements of Astronomical Science, and also in the first of his autobiographical poems. The Preface to the former has a long and diffuse account of Manuel's character, scientific activities, and the instruction which he provided, but nowhere says however that he was a priest[33]. The relevant passage in the poem is quite short but reports an important detail not provided in the Preface, namely that Manuel had a Persian teacher[34]. The relevant section of the poem is as follows,

νῦν ἐρέω. Βρυένιος ἔην τις τῆδ' ἂρ ἐπίκλην
μὴ 'π' ὀλίγον χρόνον αὐτὸς ἔχων φάμαν ἀστρονομίης
ἠδὲ μαθηματικῆς ἄλλης σοφίης νύ τ' ἔχειν εὖ.
τῶ δ' ἐπιμωκέατ' ἠδ' ἐπιγείλαον ἄλλοι πάντες
ἠν' ἂρ' ἐγὼν ἀνόνητον πλαναομένω πλάνον
ἠὲ πλανάαν ἄλλους εὐέλεγκται μέλοντι.
κάρτ' ἀβέλτερον ἦ τόδε γ' αὖθις ἔην πλανάασθαι
δι' ἂρα πάντεσιν ἀνθρώποις λαθέειν ὀίεσθαι.
ἀλλὰ τόδ' οὐκ ἔχεν, ὡς δόκεε πλείστοις κἄμοιγε·
ἀλλ' ἂρ' ἔην ὤνθρωπος ἀλαθὴς καί τε μάλ' ἤδει,
ὧν πέρι μὴ δόκε' ἴδμεν', ἀλλὰ ληρεῖν αὔτως,
καὶ τόδ' ἂρ, ὡς φάτο, πάρ του Πάροθεν ἀρχὰς λαβών,
μὴ δὲ γὰρ ἐξεῖν' ἄλλως, χ' ὅς κεν ἐρεῖ, ἐρέει μάψ,
Περσίδος ἐξ ἄποθ' ἐνθάδ' ἴδμονος ἱκομένοιο·
καὶ τό γ' ἂρ ἀλαθές, ὡς ἂρ' ἐκεῖ κρατέει σοφί' αὖτη,
καὶ μάλα τ' ἴδμεν ἅπαντες.

There was thus a certain man named Bryennius, not a little while ago, who taught well in astronomy and the rest of mathematical science. Some mocked him, and the rest smiled at him, as did I, since he was concerned to make vain errors and to lead others astray in matters that were easy to test. That was in truth very silly and yet he was deceived in supposing it would escape the notice of all men. But it was not so, since it was apparent to most and to me too. But then the man was truthful, and knew everything about which he seemed not to have known, but spoke quite foolishly, and this, as he said, taking

> the principles from someone before him[35], for he said it was not possible otherwise (he will ask in vain), the Persian scholar having come from afar to this country. For this is true, since there wisdom itself prevails, as we all indeed know.

While the Poem appears to have been written at the end of his life, Metochites states that he was aged 43 when he received Manuel's instruction, that is in 1311-2. As for Manuel's reported Persian contact, it must be stressed that nothing in his own writing or in the signs of the influence which he had with Metochites reveals this aspect. The latter's astronomical writing shows no sign of non-Ptolemaic material.

Planudes corresponded with Bryennius, and in his edition of this correspondance, Treu argued from chronological considerations that Bryennius wrote his *Harmonika ca* 1300[36]; Planudes wrote to him as 'his old friend'. This would suggest that he was born perhaps *ca* 1260, 10 years older than Metochites. In 1336 he would be aged well over 70, certainly too old to be considered as the author of the Almanac.

If the two Manuel's were the same one would have expected Chrysococces to have named him as Bryennios, and to have aluded to his reputation in Constantinople where he was known to everyone. Metochites in the course of a long account nowhere says that Manuel Bryennius was a priest. Moreover if he had become a monk after his association with Metochites he would normally have changed his name.

People have in the past discussed whether the two Manuel's are the same. The argument depends in large part on the chronology of these activities. Usener and Beck assumed they were the same person, while Lampsides, and Constantinides argued against it. Jonker seems to come down in favour of identity. Ševčenko (here followed by Constantinides) urged that Bryennius' Persian source was Chioniades, but there is no real support for this, and it would depend either on the identity of the two Manuel's, or on the supposition that Chioniades was active in Constantinople[37].

In conclusion, we take the view that the priest Manuel in Trebizond is the author of the Almanac, and that he is not the same as Manuel Bryennius.

NOTES TO THE COMMENTARY

1. The symbol ϱ attached to κλῆρος in the sign ♄ certainly represents δαίμονος, Bouché-Leclerq (1899), Fig.37.
2. Grumel (1958), p.128.
3. Grumel (1958), p.139.
4. Grumel (1958), pp.212-3, 311, 320-2.
5. Mahler (1916), pp.569, 616.
6. These and the other graphs are collected at the end of the volume.
7. The quantities κ′ and Γ'_S are given in table XVIIa in the edition, Pingree (1986), Part 2, p.15.
8. Pingree (1985), Part 1, 104, Part 2, pp.35-40.
9. The earlier work of Kennedy (1977) is now replaced by that of Tihon (1989) and Mercier (1989).
10. The Arabic text has been consulted in three manuscripts, British Library MS Or.6669, Vatican MS Ar.761. The third was a copy purchased on July 4 1985 by B. Quaritch of London from Christie's of London; through the courtesy of both establishments I had an opportunity to examine it. The Greek version, σαντζαρῆ σύνταξις, is in Vatican MSS gr 1058, 211.
11. The Greek text has been published by Pingree (1987). For notes on related tables see Mercier (1988).
12. Mercier (1987).
13. The Adwār al-anwār was consulted in the Chester Beatty Library (Dublin) MS 3665, and in the University Library Leiden MS Or.110 (which lacks the tables for Mercury and Venus). The Tāj al-azyāj was consulted in the Chester Beatty Library (Dublin) MS 4129.
14. Pingree (1985), Part 1, 159.
15. Mercier (1984). p. 52.
16. Kennedy (1987) 358.
17. Geography, V.6.11. Note that Ptolemy includes Trebizond twice in the Geography, where at V.6.5 he gives the longitude 70;50. The reference is to Nobbe's edition, Nobbe (1845).
18. Escorial MS Σ-I-11, fol.55^{r}. There is also a list extracted from the Zīj al-Sanjarī, which does not include Trebizond.
19. CCAG, Vol.7 (1908), pp.152-160.
20. Lampsides (1958b, p.65.3)
21. Grumel (1958), p.128.
22. The attack on the castle is interpreted by Bryer (1896a) as the response of the populace to the immoral life of the Emperor.
23. Lampsides (1958b), p.50. The correction had earlier been made by Oikonomides (1957), p.77.

24. Pingree (1988), pp.289-293.
25. This is a fourteenth century MS, Monacensis 287, fol.126; CCAG 7, p.123.9-124.3.
26. For a general discussion of Kaid see Hartner (1968). In the Greek version of the Zīj al-'Alā'ī, the planet is referred to as Κάϊτ ἀστέρος κακοποιοῦ παρ' Ἰνδοῖς; Pingree (1985), Part 2, p.24. If there is connection with Kaid, the symbol κκ may represent κακοποιοῦ. Note finally the term κάκωσις, used elsewhere in classical astrology, but in quite another connection; Bouché-Leclercq, p.254.
27. Bouché-Leclercq (1899), p.195.
28. Bouché-Leclercq (1899) pp.111 seq.
29. The Greek text is known from Usener (1914), p.356.
30. Chapter 48; edited from Vat gr.210 by Dachy (1968), p.64.
31. Dachy (1986), p.68; see also Tihon (1987), p.478.
32. Here I accept the date of birth as determined by Ševčenko (1975), p.25 n.36; cf. Ševčenko (1962), pp. 135, 269.
33. This Preface was published by Sathas (1872), pp.πε-ρια. The portion concerning Manuel is in pp.ϡθ seq.
34. The poem was published in Treu (1895). That edition is unavailable to me however, and I quote it from Dachy (1986), p.161, who discusses the problem of the identity of the Manuels.
35. Perhaps a play on words with Persian Πάροθεν/Περσίδος.
36. Treu (1889), p.185; Jonker (1970), p.20.
37. Usener (1914), vol.3, p.349; Lampsides (1938); Beck (1952), p.8 n.2; Jonker (1970), p.32 n.84; Ševčenko (1975), p.28 n.72; Constantinides (1982), p.95.

TRANSCRIPTION

ALMANAC FOR TREBIZOND, A.D.1336-7, A.H.736-7
(Corrected Calendar)

MONTH 1

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		3	28	12	0; 4	340; 9	218; 1	36; 4	16;35	340;59	333;41	3;40	12; 1
2		4	29	13	1; 3	353;23	217;59	36;17	17;20	340;55	335;10	3;37	12; 4
3		5	30	14	2; 2	6;53	217;57	36;30	18; 4	340;51	336;37	3;34	12; 7
4	SHAB'AN	6	1	15	3; 1	20;44	217;54	36;43	18;48	340;47	338; 4	3;30	12;10
5		7	2	16	4; 0	34;56	217;51	36;56	19;32	340;44	339;31	3;27	12;13
6		1	3	17	4;59	49;30	217;48	37; 9	20;16	340;40	340;57	3;24	12;16
7		2	4	18	5;57	64;23	217;45	37;22	21; 0	340;36	342;37	3;21	12;19
8		3	5	19	6;56	79; 4	217;42	37;35	21;43	340;32	344;17	3;18	12;21
9		4	6	20	7;54	93;17	217;39	37;48	22;27	340;28	345;57	3;14	12;24
10		5	7	21	8;53	107; 9	217;36	38; 1	23;10	340;24	347;37	3;11	12;27
11		6	8	22	9;51	120;56	217;33	38;14	23;54	340;20	349;18	3; 8	12;30
12		7	9	23	10;50	134;57	217;29	38;27	24;33	340;31	351; 5	3; 5	12;33
13	PALM SUNDAY	1	10	24	11;48	148;39	217;25	38;40	25;20	340;42	352;52	3; 2	12;36
14		2	11	25	12;47	161;52	217;21	38;53	25;51	340;53	354;39	2;58	12;39
15		3	12	26	13;45	174;59	217;17	39; 6	26;30	341; 4	356;26	2;54	12;42
16		4	13	27	14;44	187;39	217;13	39;19	27; 9	341;15	358;13	2;51	12;45
17		5	14	28	15;43	200;13	217; 9	39;32	27;48	341;26	0; 2	2;48	12;48
18		6	15	29	16;41	212;43	217; 5	39;45	28;27	341;37	1;51	2;45	12;51
19	PASCH. TERM	7	16	30	17;40	224;56	217; 1	39;58	29; 7	341;49	3;40	2;42	12;54
20	EASTER	1	17	31	18;39	236;59	216;57	40;11	29;47	342; 3	5;29	2;39	12;57
21	APRIL	2	18	1	19;37	248;55	216;53	40;22	30;27	342;12	7;17	2;37	13; 0
22		3	19	2	20;35	260;40	216;49	40;36	30;42	342;43	9; 8	2;34	13; 2
23		4	20	3	21;33	272;38	216;44	40;50	31;24	343;14	10;59	2;30	13; 5
24		5	21	4	22;32	285; 9	216;40	41; 4	32; 6	343;45	12;50	2;27	13; 7
25		6	22	5	23;30	297;56	216;35	41;18	32;48	344;16	14;42	2;24	13; 9
26		7	23	6	24;28	310;42	216;31	41;32	33;30	344;47	16;34	2;21	13;12
27		1	24	7	25;27	323;15	216;26	41;46	34;13	345;18	18;26	2;18	13;14
28		2	25	8	26;25	335;59	216;22	42; 0	34;56	345;49	20;19	2;14	13;17
29		3	26	9	27;23	348;55	216;17	42;14	35;36	346;20	22;12	2;11	13;19
30		4	27	10	28;21	0;56	216;12	42;28	36;22	346;52	24; 5	2; 8	13;21

MONTH 2

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		5	28	11	28;16	15;48	216; 7	42;41	37;32	347;25	25;57	2; 5	13;23
2		6	29	12	29;13	29;56	216; 1	42;56	38;22	348;12	27;52	2; 2	13;25
3	RAMADHAN	7	1	13	30;10	43;50	215;56	43;12	39;12	348;59	29;47	1;59	13;28
4		1	2	14	31; 8	58;14	215;51	43;28	40; 2	349;46	31;42	1;55	13;30
5		2	3	15	32; 5	72;50	215;46	43;44	40;52	350;33	33;37	1;52	13;33
6		3	4	16	33; 2	87;57	215;41	44; 0	41;42	351;20	35;30	1;49	13;35
7		4	5	17	34; 0	102;48	215;36	44;16	42;32	352; 7	37;23	1;46	13;38
8		5	6	18	34;57	117;35	215;31	44;32	43;22	352;54	39;16	1;43	13;40
9		6	7	19	36;54	131;47	215;26	44;48	44;12	353;41	41; 9	1;39	13;43
10		7	8	20	37;52	144;26	215;21	44;54	45; 2	354;28	43; 2	1;36	13;45
11		1	9	21	38;49	157;48	215;16	45; 0	45;51	355;12	44;54	1;33	13;48
12		2	10	22	39;46	171;35	215;12	45;14	46;31	356; 2	46;45	1;30	13;50
13		3	11	23	40;43	184;22	215; 7	45;28	47;12	356;52	48;36	1;27	13;53
14		4	12	24	41;41	196;52	215; 3	45;42	47;53	357;42	50;27	1;23	13;55
15		5	13	25	42;38	209;14	214;58	45;56	48;34	358;32	52;18	1;20	13;58
16		6	14	26	43;35	221;24	214;54	46;10	49;15	359;22	54; 9	1;17	14; 0
17		7	15	27	44;32	233;23	214;49	46;24	49;56	0;12	56; 0	1;14	14; 2
18		1	16	28	45;30	245;25	214;45	46;38	50;37	1; 2	57;51	1;11	14; 4
19		2	17	29	45;27	257;22	214;40	46;52	51;18	1;53	59;41	1; 8	14; 7
20		3	18	30	46;24	269;15	214;36	47; 6	51;59	2;43	61;31	1; 5	14;10
21	MAY	4	19	1	47;21	280;57	214;31	47;20	52;42	3;34	63;21	1; 2	14;12
22		5	20	2	48;19	292;38	214;25	47;34	53;25	4;30	65; 3	0;58	14;14
23		6	21	3	49;16	304;34	214;20	47;48	54; 8	5;26	66;45	0;55	14;17
24		7	22	4	50;13	316; 8	214;15	48; 2	54;51	6;22	68;27	0;52	14;19
25		1	23	5	51;10	328;58	214;10	48;16	55;34	7;18	70; 9	0;49	14;21
26		2	24	6	52; 7	342; 3	214; 5	48;31	56;17	8;14	71;49	0;46	14;23
27		3	25	7	53; 4	355;17	214; 0	48;46	57; 0	9;10	73;24	0;42	14;25
28		4	26	8	54; 1	8;48	213;55	49; 1	57;43	10; 6	74;58	0;39	14;27
29		5	27	9	54;59	24;43	213;50	49;16	58;26	11; 0	76;39	0;33	14;29
30		6	28	10	55;56	36;52	213;45	49;30	59; 9	11;53	78; 6	0;33	14;30

MONTH 3

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		7	29	11	58;16	53;18	213;40	49;46	59;51	12;57	79;41	0;29	14;33
2		1	30	12	59;13	67;59	213;36	50; 1	60;33	13;52	81; 5	0;26	14;34
3	SHAWWAL	2	1	13	60;10	82;51	213;32	50;15	61;15	14;47	82;29	0;23	14;36
4		3	2	14	61; 8	97;36	213;28	50;29	61;57	15;42	83;53	0;19	14;37
5		4	3	15	62; 5	112;26	213;24	50;43	62;39	16;37	85;17	0;16	14;39
6		5	4	16	63; 2	127;12	213;20	50;57	63;21	17;32	86;39	0;13	14;40
7		6	5	17	64; 0	141;31	213;16	51;11	64; 3	18;27	87;46	0;10	14;42
8		7	6	18	64;57	155;18	213;12	51;25	64;45	19;22	88;53	0; 7	14;43
9		1	7	19	65;54	168;45	213; 8	51;39	65;27	20;17	90; 0	0; 3	14;45
10		2	8	20	66;52	181;49	213; 5	51;53	66; 9	21;13	91; 8	0; 0	14;46
11		3	9	21	67;49	194;34	213; 2	52; 7	66;49	22; 9	92;16	359;57	14;48
12		4	10	22	68;46	207; 3	212;58	52;21	67;31	23;17	93; 2	359;54	14;49
13		5	11	23	69;43	219;16	212;55	52;35	68;13	24;25	93;47	359;51	14;51
14		6	12	24	70;48	231;22	212;51	52;49	68;55	25;33	94;32	359;47	14;51
15		7	13	25	71;38	242;36	212;48	53; 3	69;37	26;41	95;17	359;44	14;52
16		1	14	26	72;35	254;13	212;44	53;16	70;19	27;49	95;59	359;41	14;53
17		2	15	27	73;32	266; 6	212;40	53;29	71; 0	28;57	96;12	359;38	14;54
18		3	16	28	74;30	278;18	212;36	53;42	71;41	30; 5	96;25	359;35	14;55
19		4	17	29	75;27	290; 4	212;32	53;55	72;22	31;13	96;38	359;32	14;56
20		5	18	30	76;27	301;48	212;28	54; 8	73; 3	32;21	96;50	359;29	14;57
21		6	19	31	77;21	313;45	212;25	54;21	73;44	33;28	97; 3	359;26	14;58
22	JUNE	7	20	1	78;19	326; 3	212;22	54;34	74;25	34;34	96;34	359;22	14;59
23		1	21	2	79;16	338;45	212;19	54;48	75; 6	35;40	96; 5	359;19	14;59
24		2	22	3	80;13	351;41	212;16	55; 1	75;47	36;46	95;36	359;16	15; 0
25		3	23	4	81;10	4;59	212;13	55;15	76;27	37;52	95; 7	359;13	15; 1
26		4	24	5	82; 7	18;26	212; 9	55;28	77; 7	38;58	94;36	359;10	15; 2
27		5	25	6	83; 4	32;39	212; 6	55;42	77;47	40; 4	93;41	359; 6	15; 2
28		6	26	7	84; 1	47;18	212; 3	55;55	78;27	41;10	92;46	359; 3	15; 3
29		7	27	8	84;59	61;49	212; 0	56; 9	79; 7	42;16	91;51	359; 0	15; 4
30		1	28	9	85;56	76;56	211;57	56;24	79;47	43;22	90;56	358;57	15; 4

MONTH 2

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		5	28	11	28;16	15;48	216; 7	42;41	37;32	347;25	25;57	2; 5	13;23
2		6	29	12	29;13	29;56	216; 1	42;56	38;22	348;12	27;52	2; 2	13;25
3	RAMADHAN	7	1	13	30;10	43;50	215;56	43;12	39;12	348;59	29;47	1;59	13;28
4		1	2	14	31; 8	58;14	215;51	43;28	40; 2	349;46	31;42	1;55	13;30
5		2	3	15	32; 5	72;50	215;46	43;44	40;52	350;33	33;37	1;52	13;33
6		3	4	16	33; 2	87;57	215;41	44; 0	41;42	351;20	35;30	1;49	13;35
7		4	5	17	34; 0	102;48	215;36	44;16	42;32	352; 7	37;23	1;46	13;38
8		5	6	18	34;57	117;35	215;31	44;32	43;22	352;54	39;16	1;43	13;40
9		6	7	19	36;54	131;47	215;26	44;48	44;12	353;41	41; 9	1;39	13;43
10		7	8	20	37;52	144;26	215;21	44;54	45; 2	354;28	43; 2	1;36	13;45
11		1	9	21	38;49	157;48	215;16	45; 0	45;51	355;12	44;54	1;33	13;48
12		2	10	22	39;46	171;35	215;12	45;14	46;31	356; 2	46;45	1;30	13;50
13		3	11	23	40;43	184;22	215; 7	45;28	47;12	356;52	48;36	1;27	13;53
14		4	12	24	41;41	196;52	215; 3	45;42	47;53	357;42	50;27	1;23	13;55
15		5	13	25	42;38	209;14	214;58	45;56	48;34	358;32	52;18	1;20	13;58
16		6	14	26	43;35	221;24	214;54	46;10	49;15	359;22	54; 9	1;17	14; 0
17		7	15	27	44;32	233;23	214;49	46;24	49;56	0;12	56; 0	1;14	14; 2
18		1	16	28	45;30	245;25	214;45	46;38	50;37	1; 2	57;51	1;11	14; 4
19		2	17	29	45;27	257;22	214;40	46;52	51;18	1;53	59;41	1; 8	14; 7
20		3	18	30	46;24	269;15	214;36	47; 6	51;59	2;43	61;31	1; 5	14;10
21	MAY	4	19	1	47;21	280;57	214;31	47;20	52;42	3;34	63;21	1; 2	14;12
22		5	20	2	48;19	292;38	214;25	47;34	53;25	4;30	65; 3	0;58	14;14
23		6	21	3	49;16	304;34	214;20	47;48	54; 8	5;26	66;45	0;55	14;17
24		7	22	4	50;13	316; 8	214;15	48; 2	54;51	6;22	68;27	0;52	14;19
25		1	23	5	51;10	328;58	214;10	48;16	55;34	7;18	70; 9	0;49	14;21
26		2	24	6	52; 7	342; 3	214; 5	48;31	56;17	8;14	71;49	0;46	14;23
27		3	25	7	53; 4	355;17	214; 0	48;46	57; 0	9;10	73;24	0;42	14;25
28		4	26	8	54; 1	8;48	213;55	49; 1	57;43	10; 6	74;58	0;39	14;27
29		5	27	9	54;59	24;43	213;50	49;16	58;26	11; 0	76;39	0;33	14;29
30		6	28	10	55;56	36;52	213;45	49;30	59; 9	11;53	78; 6	0;33	14;30

MONTH 3

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		7	29	11	58;16	53;18	213;40	49;46	59;51	12;57	79;41	0;29	14;33
2		1	30	12	59;13	67;59	213;36	50; 1	60;33	13;52	81; 5	0;26	14;34
3	SHAWWAL	2	1	13	60;10	82;51	213;32	50;15	61;15	14;47	82;29	0;23	14;36
4		3	2	14	61; 8	97;36	213;28	50;29	61;57	15;42	83;53	0;19	14;37
5		4	3	15	62; 5	112;26	213;24	50;43	62;39	16;37	85;17	0;16	14;39
6		5	4	16	63; 2	127;12	213;20	50;57	63;21	17;32	86;39	0;13	14;40
7		6	5	17	64; 0	141;31	213;16	51;11	64; 3	18;27	87;46	0;10	14;42
8		7	6	18	64;57	155;18	213;12	51;25	64;45	19;22	88;53	0; 7	14;43
9		1	7	19	65;54	168;45	213; 8	51;39	65;27	20;17	90; 0	0; 3	14;45
10		2	8	20	66;52	181;49	213; 5	51;53	66; 9	21;13	91; 8	0; 0	14;46
11		3	9	21	67;49	194;34	213; 2	52; 7	66;49	22; 9	92;16	359;57	14;48
12		4	10	22	68;46	207; 3	212;58	52;21	67;31	23;17	93; 2	359;54	14;49
13		5	11	23	69;43	219;16	212;55	52;35	68;13	24;25	93;47	359;51	14;51
14		6	12	24	70;48	231;22	212;51	52;49	68;55	25;33	94;32	359;47	14;51
15		7	13	25	71;38	242;36	212;48	53; 3	69;37	26;41	95;17	359;44	14;52
16		1	14	26	72;35	254;13	212;44	53;16	70;19	27;49	95;59	359;41	14;53
17		2	15	27	73;32	266; 6	212;40	53;29	71; 0	28;57	96;12	359;38	14;54
18		3	16	28	74;30	278;18	212;36	53;42	71;41	30; 5	96;25	359;35	14;55
19		4	17	29	75;27	290; 4	212;32	53;55	72;22	31;13	96;38	359;32	14;56
20		5	18	30	76;27	301;48	212;28	54; 8	73; 3	32;21	96;50	359;29	14;57
21		6	19	31	77;21	313;45	212;25	54;21	73;44	33;28	97; 3	359;26	14;58
22	JUNE	7	20	1	78;19	326; 3	212;22	54;34	74;25	34;34	96;34	359;22	14;59
23		1	21	2	79;16	338;45	212;19	54;48	75; 6	35;40	96; 5	359;19	14;59
24		2	22	3	80;13	351;41	212;16	55; 1	75;47	36;46	95;36	359;16	15; 0
25		3	23	4	81;10	4;59	212;13	55;15	76;27	37;52	95; 7	359;13	15; 1
26		4	24	5	82; 7	18;26	212; 9	55;28	77; 7	38;58	94;36	359;10	15; 2
27		5	25	6	83; 4	32;39	212; 6	55;42	77;47	40; 4	93;41	359; 6	15; 2
28		6	26	7	84; 1	47;18	212; 3	55;55	78;27	41;10	92;46	359; 3	15; 3
29		7	27	8	84;59	61;49	212; 0	56; 9	79; 7	42;16	91;51	359; 0	15; 4
30		1	28	9	85;56	76;56	211;57	56;24	79;47	43;22	90;56	358;57	15; 4

MONTH 4

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		2	29	10	86;54	91;44	211;53	56;37	80;27	44;27	90; 0	358;54	15; 5
2	DHU'L QA'DA	3	1	11	87;51	105;51	211;51	56;50	81; 8	45;32	89; 1	358;51	15; 5
3		4	2	12	88;48	120;32	211;49	57; 3	81;49	46;37	88; 3	358;48	15; 5
4		5	3	13	89;45	135; 7	211;47	57;16	82;30	47;42	87; 4	358;44	15; 5
5		6	4	14	90;43	149;39	211;45	57;29	83;11	48;47	86; 5	358;41	15; 4
6		7	5	15	91;40	163;49	211;43	57;42	83;52	49;53	85; 6	358;38	15; 4
7		1	6	16	92;32	177;35	211;42	57;55	84;33	50;59	84;30	358;35	15; 4
8		2	7	17	93;34	187;54	211;41	58; 8	85;14	52; 5	83;24	358;32	15; 3
9		3	8	18	94;31	203;44	211;40	58;21	85;54	53;11	82;48	358;28	15; 3
10		4	9	19	95;28	216;10	211;39	58;34	86;34	54;17	82;24	358;25	15; 3
11		5	10	20	96;25	228;20	211;38	58;47	87;14	55;23	82; 5	358;22	15; 2
12		6	11	21	97;23	240;16	211;37	59; 0	87;54	56;32	82;11	358;19	15; 2
13		7	12	22	98;20	252; 4	211;36	59;13	88;34	57;41	82;17	358;16	15; 1
14		1	13	23	99;17	263;54	211;35	59;25	89;14	58;50	82;23	358;12	15; 0
15		2	14	24	100;14	275;26	211;34	59;37	89;54	59;59	82;29	358; 9	14;59
16		3	15	25	101;11	287;44	211;33	59;49	90;34	61; 8	82;36	358; 6	14;58
17		4	16	26	102; 9	299;44	211;32	60; 1	91;14	62;17	83;14	358; 3	14;58
18		5	17	27	103; 6	310;58	211;31	60;13	91;53	63;26	83;52	358; 0	14;57
19		6	18	28	104; 3	323;26	211;30	60;25	92;32	64;35	84;30	357;57	14;56
20		7	19	29	105; 0	335;28	211;29	60;37	93;11	65;44	85; 8	357;54	14;55
21		1	20	30	105;57	347;34	211;29	60;49	93;50	66;53	85;45	357;51	14;55
22	JULY	2	21	1	106;54	0;26	211;29	61; 0	94;29	68; 2	86;49	357;47	14;54
23		3	22	2	107;51	13;30	211;29	61;12	95; 8	69;10	87;53	357;44	14;53
24		4	23	3	108;48	26;59	211;29	61;24	95;47	70;18	88;57	357;41	14;52
25		5	24	4	109;45	39;50	211;29	61;36	96;46	71;26	90; 1	357;38	14;51
26		6	25	5	110;42	55;10	211;29	61;48	97; 5	72;34	91; 6	357;35	14;49
27		7	26	6	111;39	70; 0	211;29	61;59	97;44	73;42	92;16	357;31	14;48
28		1	27	7	112;36	84;50	211;29	62;10	98;23	74;50	93;26	357;28	14;47
29		2	28	8	113;34	99;47	211;29	62;21	99; 2	76; 2	94;36	357;25	14;46
30		3	29	9	114;31	114;43	211;29	62;32	99;41	77;10	96;46	357;21	14;44

MONTH 5

	CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1	4	30	10	115;29	129;41	211;30	62;44	100;22	78;14	97;53	357;18	14;43
2 DHU'L-HIJJA	5	1	11	116;27	143;55	211;31	62;54	100;53	79;28	99;24	357;15	14;41
3	6	2	12	117;24	157;56	211;32	63; 5	101;32	80;42	100;56	357;12	14;40
4	7	3	13	118;22	171;47	211;33	63;15	102;11	81;56	102;28	357; 8	14;38
5	1	4	14	119;20	185;22	211;34	63;26	102;50	83;10	104; 0	357; 5	14;37
6	2	5	15	120;17	198;35	211;35	63;36	103;29	84;24	105;32	357; 2	14;35
7	3	6	16	121;15	211;33	211;36	63;47	104; 8	85;38	107;14	356;59	14;33
8	4	7	17	122;12	224;38	211;37	63;57	104;47	86;52	108;56	356;56	14;31
9	5	8	18	123;10	237;30	211;38	64; 8	105;23	88; 6	110;38	356;52	14;29
10	6	9	19	124; 7	250; 0	211;40	64;18	106; 3	89;20	112;20	356;49	14;27
11	7	10	20	125; 5	261;56	211;43	64;29	106;49	90;25	114; 0	356;46	14;25
12	1	11	21	126; 6	272;33	211;45	64;38	107;29	91;32	115;44	356;43	14;23
13	2	12	22	127; 0	284;19	211;47	64;47	108; 9	92;39	117;28	356;40	14;20
14	3	13	23	127;58	296;17	211;49	64;56	108;49	93;46	119;12	356;36	14;18
15	4	14	24	128;56	307;49	211;51	65; 5	109;29	94;53	120;55	356;33	14;16
16	5	15	25	129;53	319;55	211;53	65;14	110;10	96; 0	122;39	356;30	14;14
17	6	16	26	130;51	332;48	211;55	65;23	110;50	97; 7	124;29	356;27	14;12
18	7	17	27	131;48	345; 9	211;57	65;32	111;30	98;14	126;18	356;24	14; 9
19	1	18	28	132;46	357;39	212; 0	65;41	112;10	99;21	128; 7	356;21	14; 7
20	2	19	29	133;44	10;20	212; 2	65;50	112;50	100;27	129;56	356;18	14; 5
21	3	20	30	134;46	23;11	212; 5	66; 0	113;31	101;31	131;47	356;15	14; 2
22	4	21	31	135;39	36;30	212; 7	66; 8	114; 8	102;44	133;37	356;11	14; 0
23 AUGUST	5	22	1	136;37	50;11	212;10	66;16	114;44	103;55	135;28	356; 8	13;58
24	6	23	2	137;35	65;12	212;13	66;24	115;20	105; 8	137;18	356; 5	13;56
25	7	24	3	138;32	79;23	212;16	66;32	115;56	106;20	139; 9	356; 2	13;53
26	1	25	4	139;30	94;13	212;19	66;40	116;32	107;32	140;59	355;59	13;51
27	2	26	5	140;28	109;10	212;22	66;48	117; 8	108;44	142;44	355;55	13;48
28	3	27	6	141;26	124;54	212;25	66;56	117;44	109;56	144;34	355;52	13;46
29	4	28	7	142;23	138;51	212;28	67; 4	118;20	111; 8	146;21	355;49	13;44
30	5	29	8	143;21	152;52	212;31	67;12	118;56	112;20	148; 8	355;46	13;41

MONTH 6

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		6	30	9	144;16	166;35	212;34	67;21	119;32	113;34	149;53	355;43	13;39
2	MUHARRAM	7	1	10	145;14	180;19	212;38	67;28	120;18	114;48	151;42	355;40	13;37
3		1	2	11	146;13	193;34	212;42	67;35	120;49	116; 1	153;31	355;37	13;34
4		2	3	12	147;11	206;28	212;46	67;42	121;28	117;15	155;20	355;33	13;31
5		3	4	13	148; 9	219;11	212;50	67;49	122; 7	118;28	157; 9	355;30	13;29
6		4	5	14	149; 7	231;47	212;54	67;55	122;46	119;42	158;56	355;27	13;26
7		5	6	15	150; 5	244;31	212;58	68; 1	123;25	120;55	160;41	355;24	13;24
8		6	7	16	151; 3	257;17	213; 2	68; 7	124; 4	122; 9	162;26	355;21	13;21
9		7	8	17	152; 1	269;46	213; 6	68;13	124;43	123;22	164;11	355;17	13;19
10		1	9	18	152;59	281;47	213;10	68;19	125;21	124;36	165;56	355;14	13;16
11		2	10	19	153;58	293;39	213;13	68;25	125;59	125;48	167;42	355;11	13;13
12		3	11	20	154;56	305;24	213;18	68;31	126;39	127; 0	169;20	355; 8	13;10
13		4	12	21	155;54	317;27	213;23	68;36	127;18	128;12	170;58	355; 5	13; 8
14		5	13	22	156;53	328;53	213;28	68;41	127;57	129;24	172;36	355; 1	13; 5
15		6	14	23	157;51	341;22	213;35	68;46	128;26	130;36	174;14	354;58	13; 2
16		7	15	24	158;50	354;18	213;38	68;51	129;15	131;48	175;53	354;55	13; 0
17		1	16	25	159;48	7; 8	213;45	68;56	129;54	133; 0	177;17	354;52	12;57
18		2	17	26	160;46	20; 3	213;48	69; 1	130;33	134;24	179; 1	354;49	12;54
19		3	18	27	161;45	33;25	213;55	69; 6	131;20	135;24	180;35	354;46	12;51
20		4	19	28	162;43	47;30	213;58	69;11	131;51	136;36	182; 9	354;43	12;48
21		5	20	29	163;42	61;22	214; 5	69;16	132;29	137;49	183;43	354;40	12;45
22		6	21	30	164;40	75; 0	214;10	69;19	133; 6	139; 2	185;10	354;36	12;42
23		7	22	31	165;39	88;52	214;15	69;22	133;42	140;15	186;36	354;33	12;40
24	SEPTEMBER	1	23	1	166;38	103; 5	214;20	69;25	134;18	141;28	188; 2	354;30	12;37
25	IND 5	2	24	2	167;37	117;54	214;25	69;28	134;54	142;41	189;28	354;27	12;35
26		3	25	3	168;35	132;41	214;30	69;31	135;30	143;55	190;54	354;24	12;32
27		4	26	4	169;34	148;12	214;35	69;34	136; 6	145; 8	192; 5	354;20	12;29
28		5	27	5	170;33	161;58	214;40	69;37	136;42	146;22	193;16	354;17	12;27
29		6	28	6	171;31	175;31	214;45	69;40	137;18	147;35	194;27	354;14	12;24
30		7	29	7	172;30	188;56	214;50	69;43	137;54	148;48	195;38	354;11	12;21

MONTH 7

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		1	30	8	173;29	202; 7	214;56	69;46	138;30	150; 2	196;51	354; 8	12;18
2	SAFAR	2	1	9	174;28	215; 3	215; 2	69;47	139; 9	151;16	197;48	354; 5	12;15
3		3	2	10	175;27	227;41	215; 8	69;48	139;48	152;30	198;45	354; 2	12;12
4		4	3	11	176;26	240; 6	215;14	69;49	140;27	153;44	199;42	353;58	12;10
5		5	4	12	177;25	252;26	215;20	69;50	141; 6	154;58	200;39	353;55	12; 7
6		6	5	13	178;24	264;52	215;27	69;51	141;45	156;12	201;36	353;52	12; 5
7		7	6	14	179;23	277;35	215;33	69;52	142;24	157;26	202;13	353;49	12; 2
8		1	7	15	180;22	290;16	215;39	69;53	143; 3	158;40	202;26	353;46	12; 0
9		2	8	16	181;21	301;13	215;45	69;54	143;42	159;54	203;30	353;42	11;57
10		3	9	17	182;21	313;20	215;51	69;55	144;21	161;20	204;38	353;39	11;55
11		4	10	18	183;20	325;33	215;58	69;55	144;57	162;24	204;48	353;36	11;52
12		5	11	19	184;19	337;59	216; 4	69;55	145;36	163;38	204;58	353;33	11;50
13		6	12	20	185;19	350;37	216;10	69;54	146;15	164;52	205; 7	353;30	11;47
14		7	13	21	186;18	1; 5	216;17	69;53	146;54	166; 6	205;17	353;26	11;44
15		1	14	22	187;18	15;30	216;24	69;52	147;33	167;20	205;26	353;23	11;41
16		2	15	23	188;17	29;41	216;31	69;51	148;20	168;34	205;15	353;20	11;38
17		3	16	24	189;17	43; 3	216;38	69;50	148;51	169;48	205; 4	353;17	11;35
18		4	17	25	190;16	56;43	216;45	69;48	149;30	171; 2	204;53	353;14	11;32
19		5	18	26	191;16	72;45	216;52	69;46	150; 9	172;16	204;40	353;11	11;29
20		6	19	27	192;15	87;12	216;59	69;45	150;27	173;30	204;29	353; 8	11;26
21		7	20	28	193;15	101;17	217; 6	69;43	150;47	174;40	203;58	353; 5	11;23
22		1	21	29	194;14	115; 1	217;13	69;41	151;24	175;55	203;27	353; 1	11;20
23		2	22	30	195;14	128;51	217;20	69;39	152; 1	177;11	202;56	352;58	11;17
24	OCTOBER	3	23	1	196;14	143; 6	217;26	69;37	152;38	178;26	202;25	352;55	11;14
25	SUN CYC 13	4	24	2	197;14	157;20	217;32	69;34	153;15	179;42	201;52	352;52	11;11
26		5	25	3	198;13	171;13	217;38	69;31	153;52	180;57	201;15	352;49	11; 8
27		6	26	4	199;13	184;41	217;44	69;28	154;29	182;13	200;38	352;45	11; 5
28		7	27	5	200;13	197;39	217;50	69;25	155; 6	183;28	200; 1	352;42	11; 2
29		1	28	6	201;13	210;25	217;56	69;22	155;43	184;44	199;24	352;39	10;59
30		2	29	7	202;13	223;47	218; 2	69;19	156;20	185;59	199; 0	352;36	10;56

MONTH 8

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1	RAB'I I	3	1	8	203;12	235;41	218; 8	69;16	156;56	187;15	198;46	352;32	10;53
2		4	2	9	204;12	247;53	218;15	69;12	157;31	188;30	198;28	352;29	10;50
3		5	3	10	205;12	259;53	218;22	69; 8	158; 6	189;45	198;10	352;26	10;48
4		6	4	11	206;12	271;52	218;29	69; 4	158;41	191; 0	197;52	352;22	10;45
5		7	5	12	207;12	283;52	218;36	69; 0	159;16	192;15	197;34	352;19	10;42
6		1	6	13	208;12	296;21	218;43	68;55	159;51	193;30	197;18	352;16	10;39
7		2	7	14	209;12	309; 7	218;49	68;50	160;26	194;45	197;24	352;13	10;37
8		3	8	15	210;12	321;44	218;56	68;45	161; 1	196; 0	197;30	352;10	10;34
9		4	9	16	211;13	334; 9	219; 5	68;40	161;37	197;16	197;36	352; 6	10;31
10		5	10	17	212;13	346;35	219;11	68;35	162;12	198;32	197;42	352; 3	10;48
11		6	11	18	213;14	359;19	219;22	68;30	162;48	199;48	197;50	352; 0	10;25
12		7	12	19	214;14	12;12	219;29	68;26	163;24	201;20	198;13	351;57	10;22
13		1	13	20	215;15	24;15	219;36	68;22	164; 0	202;36	198;36	351;54	10;20
14		2	14	21	216;15	38;13	219;43	68;18	164;36	203;52	198;59	351;50	10;17
15		3	15	22	217;16	53;12	219;50	68; 3	165;12	205; 8	199;22	351;47	10;15
16		4	16	23	218;16	67;14	219;58	67;58	165;48	206;23	199;43	351;44	10;12
17		5	17	24	219;17	81;44	220; 5	67;53	166;24	207;38	200;49	351;41	10;10
18		6	18	25	220;17	96;28	220;12	67;48	167; 0	208;53	201;54	351;38	10; 7
19		7	19	26	221;18	111;17	220;19	67;43	167;36	210; 8	202;59	351;35	10; 5
20		1	20	27	222;19	125;37	220;26	67;36	168;14	211;15	204; 4	351;32	10; 2
21		2	21	28	223;19	139;26	220;34	67;29	168;51	212;22	205; 9	351;29	9;59
22		3	22	29	224;20	154;29	220;41	67;23	169;26	213;39	206;18	351;25	9;56
23		4	23	30	225;20	168; 1	220;48	67;17	170; 1	214;55	207;28	351;22	9;54
24		5	24	31	226;21	181;26	220;55	67;11	170;36	216;11	208;38	351;19	9;52
25	NOVEMBER	6	25	1	227;22	193;33	221; 2	67; 5	171;11	217;27	209;48	351;16	9;49
26		7	26	2	228;22	207;21	221;10	66;59	171;46	218;43	210;58	351;13	9;46
27		1	27	3	229;23	219;59	221;17	66;54	172;20	219;59	212;20	351; 9	9;43
28		2	28	4	230;23	231;54	221;24	66;49	172;54	221;15	213;42	351; 6	9;41
29		3	29	5	231;24	244; 8	221;31	66;44	173;18	222;31	215; 4	351; 3	9;38
30		4	30	6	232;24	256;56	221;38	66;38	174; 2	223;47	216;26	351; 0	9;35

MONTH 9

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1	RAB'I 2	5	1	7	233;58	269; 2	221;46	66;31	174;35	225; 1	217;48	350;57	9;32
2		6	2	8	234;25	280;54	221;54	66;22	175; 6	226;16	219;32	350;54	9;31
3		7	3	9	235;26	292;40	222; 1	66;13	175;37	227;32	221;16	350;51	9;29
4		1	4	10	236;27	303;22	222; 8	66; 4	176; 8	228;48	223; 0	350;47	9;28
5		2	5	11	237;28	315;34	222;15	65;55	176;39	230; 4	224;44	350;44	9;26
6		3	6	12	238;29	328;17	222;22	65;45	177;10	231;20	226;28	350;41	9;25
7		4	7	13	239;30	341;16	222;29	65;36	177;41	232;36	227;50	350;38	9;23
8		5	8	14	240;31	354; 8	222;36	65;27	178;12	233;52	229;12	350;35	9;21
9		6	9	15	241;32	7; 7	222;43	65;18	178;42	235; 8	231;34	350;31	9;20
10		7	10	16	242;33	20;21	222;50	65; 9	179;12	236;24	232;56	350;28	9;19
11		1	11	17	243;34	33;55	222;58	64;59	179;42	237;40	233;19	350;25	9;17
12		2	12	18	244;35	47;43	223; 5	64;50	180;19	238;56	235; 0	350;22	9;15
13		3	13	19	245;36	62;20	223;13	64;41	180;56	240;12	236;42	350;19	9;14
14		4	14	20	246;37	76;43	223;20	64;33	181;34	241;28	238;24	350;15	9;12
15		5	15	21	247;38	90;19	223;28	64;25	182;11	242;44	240; 6	350;12	9;10
16		6	16	22	248;39	106;28	223;35	64;17	182;48	244; 0	241;47	350; 9	9; 9
17		7	17	23	249;40	121;25	223;43	64; 9	183;26	245;16	243;29	350; 6	9; 7
18		1	18	24	250;42	136;17	223;50	64; 1	184; 3	246;32	245;11	350; 3	9; 6
19		2	19	25	251;43	150;41	223;57	63;53	184;40	247;48	246;53	350; 0	9; 5
20		3	20	26	252;44	164;32	224; 4	63;45	185;17	249; 4	248;35	349;57	9; 4
21		4	21	27	253;45	177;59	224;11	63;37	185;55	250;22	250;15	349;54	9; 3
22		5	22	28	254;47	191;15	224;18	63;29	186;27	251;36	252; 2	349;50	9; 2
23		6	23	29	255;48	204;18	224;25	63;21	187; 0	252;50	253;49	349;47	9; 1
24		7	24	30	256;49	217; 3	224;31	63;13	187;32	254; 4	255;36	349;44	9; 0
25	DECEMBER	1	25	1	257;50	229;35	224;37	63; 5	188; 4	255;18	257;23	349;41	8;59
26		2	26	2	258;52	241;16	224;43	62;58	188;37	256;32	259; 9	349;38	8;59
27		3	27	3	259;53	253; 3	224;49	62;51	189; 9	257;46	260;56	349;34	8;58
28		4	28	4	260;54	264;57	224;55	62;44	189;41	259; 0	262;43	349;31	8;57
29		5	29	5	261;55	276;51	225; 1	62;38	190;14	260;14	264;30	349;28	8;57
30	JUMADA 1	6	1	6	262;57	289;12	225; 7	62;32	190;47	261;28	266;16	349;25	8;56

MONTH 10

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		7	2	7	263;58	300;59	225;13	62;23	191;19	262;40	268; 3	349;21	8;55
2		1	3	8	264;59	312;47	225;20	62;16	191;52	263;56	269;49	349;18	8;55
3		2	4	9	266; 1	324;29	225;27	62; 9	192;24	265;12	271;35	349;15	8;55
4		3	5	10	267; 2	336;40	225;34	62; 2	192;56	266;28	273;21	349;11	8;55
5		4	6	11	268; 3	349;15	225;41	61;56	193;28	267;44	275; 8	349; 8	8;55
6		5	7	12	269; 4	2;15	225;48	61;50	194; 0	269; 0	276;55	349; 5	8;55
7		6	8	13	270; 6	15;20	225;55	61;44	194;32	270;16	278;36	349; 2	8;55
8		7	9	14	271; 7	28;20	226; 2	61;38	195; 4	271;32	280;17	348;59	8;55
9		1	10	15	272; 8	42;11	226; 9	61;32	195;36	272;48	281;58	348;55	8;55
10		2	11	16	273;10	56;24	226;15	61;26	196; 8	274; 4	283;39	348;52	8;55
11		3	12	17	274;11	70;48	226;21	61;20	196;37	275;20	285;22	348;49	8;55
12		4	13	18	275;12	85;47	226;27	61;15	197; 8	276;36	287; 2	348;46	8;55
13		5	14	19	276;14	100;23	226;33	61;10	197;39	277;52	288;42	348;43	8;55
14		6	15	20	277;15	114;38	226;39	61; 5	198;10	279; 8	290;21	348;39	8;56
15		7	16	21	278;16	129;21	226;45	61; 0	198;41	280;24	292; 1	348;36	8;56
16		1	17	22	279;17	144; 7	226;50	60;56	199;12	281;40	293;41	348;33	8;57
17		2	18	23	280;19	159;11	226;56	60;52	199;43	282;56	295;13	348;30	8;57
18		3	19	24	281;20	173;30	227; 1	60;48	200;14	284;12	296;45	348;27	8;58
19		4	20	25	282;21	187;27	227; 6	60;44	200;44	285;28	298;17	348;24	8;58
20		5	21	26	283;22	200;58	227;12	60;39	201;14	286;44	299;49	348;21	8;59
21		6	22	27	284;24	213;59	227;19	60;33	201;44	288; 1	301;21	348;18	8;59
22		7	23	28	285;25	226;37	227;24	60;30	202;14	289;17	302;44	348;14	9; 0
23		1	24	29	286;26	238;54	227;29	60;27	202;44	290;33	304; 7	348;11	9; 2
24		2	25	30	287;27	250;55	227;34	60;24	203;14	291;49	305;30	348; 8	9; 3
25		3	26	31	288;28	262;51	227;39	60;21	203;44	293; 5	306;53	348; 5	9; 4
26	JANUARY	4	27	1	289;30	274;47	227;44	60;18	204;13	294;21	308;14	348; 2	9; 5
27	MOON CYC 5	5	28	2	290;31	285;49	227;49	60;15	204;43	295;37	309;18	347;58	9; 6
28		6	29	3	291;32	297;37	227;54	60;12	205;13	296;53	310;22	347;55	9; 8
29		7	30	4	292;33	310;29	227;59	60; 9	205;43	298; 9	311;26	347;52	9;10
30	JUMADA 2	1	1	5	293;34	322;19	228; 4	60; 6	206;12	299;25	312;30	347;49	9;11

MONTH 11

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		2	2	6	294;34	334; 4	228; 9	60; 4	206;42	300;41	313;32	347;46	9;13
2		3	3	7	295;35	345;23	228;13	60; 2	207;10	301;56	314;17	347;43	9;14
3		4	4	8	296;36	357;40	228;17	60; 0	207;36	303;12	315; 2	347;40	9;15
4		5	5	9	297;37	10;20	228;21	59;58	208; 6	304;27	315;47	347;36	9;16
5		6	6	10	298;38	23;21	228;25	59;56	208;34	305;43	316;31	347;33	9;18
6		7	7	11	299;39	36;40	228;29	59;54	209; 2	306;58	317;15	347;30	9;20
7		1	8	12	300;40	50;18	228;33	59;53	209;30	308;14	317;26	347;27	9;22
8		2	9	13	301;41	64;23	228;37	59;53	209;58	309;29	317;37	347;24	9;24
9		3	10	14	302;42	78;56	228;41	59;53	210;26	310;45	317;47	347;20	9;26
10		4	11	15	303;43	93;34	228;45	59;53	210;54	312; 0	317;57	347;17	9;28
11		5	12	16	304;44	109;30	228;49	59;53	211;21	313;17	318; 7	347;14	9;30
12		6	13	17	305;45	124;11	228;54	59;53	211;46	314;32	318; 2	347;11	9;33
13		7	14	18	306;46	138;54	228;58	59;54	212;12	315;47	317;57	347; 8	9;36
14		1	15	19	307;47	153;13	229; 3	59;55	212;38	317; 2	317;52	347; 4	9;39
15		2	16	20	308;47	167;37	229; 7	59;56	213; 4	318;17	317;47	347; 1	9;42
16		3	17	21	309;48	181;58	229;11	59;57	213;30	319;32	317;42	346;58	9;45
17		4	18	22	310;49	195;43	229;15	59;58	213;56	320;47	316;24	346;55	9;48
18		5	19	23	311;50	209;14	229;20	59;59	214;22	322; 3	315; 6	346;52	9;50
19		6	20	24	312;50	222;42	229;24	60; 0	214;48	323;18	313;48	346;49	9;54
20		7	21	25	313;51	235;45	229;28	60; 1	215;14	324;34	312;30	346;46	9;57
21		1	22	26	314;52	248;20	229;32	60; 2	215;40	325;52	311;12	346;43	9;59
22		2	23	27	315;52	260;41	229;35	60; 3	216; 3	327; 7	309;54	346;39	10; 1
23		3	24	28	316;53	271;37	229;37	60; 6	216;26	328;22	308;36	346;36	10; 3
24		4	25	29	317;53	283;20	229;39	60; 9	216;49	329;37	307;18	346;33	10; 5
25		5	26	30	318;54	295; 6	229;41	60;12	217;13	330;52	305; 0	346;30	10; 7
26		6	27	31	319;54	306;59	229;43	60;15	217;37	332; 7	304;41	346;27	10; 9
27	FEBRUARY	7	28	1	320;54	318;24	229;45	60;18	218; 1	333;22	304;22	346;23	10;11
28		1	29	2	321;55	330;23	229;47	60;21	218;25	334;37	303; 3	346;20	10;13
29	RAJAB	2	1	3	322;55	343; 2	229;49	60;24	218;49	335;52	303;44	346;17	10;16
30		3	2	4	323;56	355; 9	229;51	60;27	219;13	337; 7	303;25	346;14	10;19

MONTH 12

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		4	3	5	324;57	7;11	229;53	60;30	219;37	338;22	303;20	346;11	10;22
2		5	4	6	325;57	19;49	229;55	60;34	220; 0	339;36	303; 2	346; 8	10;25
3		6	5	7	326;57	32;36	229;57	60;39	220;22	340;51	302;56	346; 5	10;28
4		7	6	8	327;58	45;58	229;59	60;44	220;44	342; 5	302;50	346; 1	10;31
5		1	7	9	328;58	59;46	230; 1	60;49	221; 6	343;20	302;44	345;58	10;34
6		2	8	10	329;58	73;39	230; 3	60;54	221;28	344;34	302;38	345;55	10;37
7		3	9	11	330;59	87;59	230; 4	60;59	221;50	345;49	303;27	345;52	10;40
8		4	10	12	331;59	102;51	230; 6	61; 4	222;12	347; 3	304;16	345;49	10;43
9		5	11	13	332;59	117;48	230; 8	61; 9	222;34	348;18	305; 5	345;45	10;46
10		6	12	14	333;59	132;39	230;10	61;14	222;56	349;33	305;54	345;42	10;49
11		7	13	15	334;59	147;49	230;11	61;19	223;15	350;48	306;42	345;39	10;52
12		1	14	16	335;59	162;10	230;12	61;25	223;32	352; 3	307;46	345;36	10;55
13		2	15	17	336;59	175;55	230;13	61;31	223;50	353;18	308;50	345;33	10;58
14		3	16	18	337;59	189;56	230;14	61;37	224; 7	354;33	309;54	345;29	11; 0
15		4	17	19	338;59	203;45	230;15	61;43	224;25	355;47	310;58	345;26	11; 3
16		5	18	20	339;59	216;47	230;15	61;50	224;42	357; 1	312; 2	345;23	11; 6
17		6	19	21	340;58	229;54	230;16	61;56	225; 0	358;15	313;24	345;20	11; 9
18		7	20	22	341;58	242;52	230;16	62; 2	225;17	359;29	314;47	345;17	11;12
19	APOKREA	1	21	23	342;58	255;36	230;17	62; 8	225;35	0;43	316;11	345;14	11;15
20		2	22	24	343;58	268;26	230;17	62;15	225;51	1;57	317;35	345;11	11;18
21		3	23	25	344;58	280;55	230;17	62;22	226; 8	3;11	318;59	345; 8	11;21
22		4	24	26	345;58	292;49	230;17	62;30	226;21	4;24	320;33	345; 4	11;23
23		5	25	27	346;57	304;34	230;17	62;38	226;33	5;38	322; 6	345; 1	11;26
24		6	26	28	347;57	316;18	230;17	62;46	226;46	6;52	323;39	344;58	11;29
25	MARCH	7	27	1	348;56	328;16	230;17	62;54	226;58	8; 6	325;12	344;55	11;32
26	TURINE	1	28	2	349;56	339;25	230;16	63; 2	227;11	9;20	326;46	344;52	11;34
27		2	29	3	350;55	351;40	230;15	63;10	227;23	10;34	328;28	344;48	11;37
28		3	30	4	351;55	4;20	230;14	63;18	227;36	11;48	330;10	344;45	11;40
29	SHABAN	4	1	5	352;54	17; 0	230;12	63;26	227;48	13; 2	331;52	344;42	11;43
30		5	2	6	353;53	29;43	230;11	63;34	228; 1	14;16	333;34	344;39	11;46

MONTH 13

		CALENDAR DAY	A.H.	A.D.	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY
1		6	3	7	354;53	42;33	230;10	63;40	228;11	15;28	335;14	343;49	11;49
2		7	4	8	355;52	55;55	230; 9	63;48	228;18	16;41	337; 3	343;46	11;51
3	ORTHODOXIA	1	5	9	356;51	69;51	230; 8	63;56	228;25	17;54	338;52	343;43	11;54
4		2	6	10	357;50	83;22	230; 7	64; 4	228;32	19; 7	340;41	343;39	11;57
5		3	7	11	358;50	97;11	230; 6	64;13	228;40	20;20	342;30	343;36	11;59
6		4	8	12	359;49	111;22	230; 4	64;22	228;47	21;31	344;20	343;33	12; 0

CALCULATIONS

ALMANAC FOR TREBIZOND, A.D.1336-7

Calculated from the Zij-i Ilkhani;
Meridian 12;0 West of Maraghah;
Equation of time not included;
Corrections to Moon, Jupiter and Saturn.

MONTH 1

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	0; 4.1	340;31.6	218; 9.1	35;59.7	16;15.2	339;47.0	333;34.9	3;40.7
2	1; 3.2	353;49.3	218; 6.4	36;12.4	16;59.8	339;32.5	334;59.8	3;37.5
3	2; 2.3	7;22.2	218; 3.6	36;25.2	17;44.2	339;20.3	336;27.2	3;34.3
4	3; 1.3	21;13.4	218; .7	36;38.0	18;28.6	339;10.4	337;57.1	3;31.1
5	4; .4	35;27.8	217;57.7	36;50.9	19;13.0	339; 2.9	339;29.1	3;28.0
6	4;59.3	50; 6.9	217;54.6	37; 3.8	19;57.4	338;57.7	341; 3.2	3;24.8
7	5;58.3	64;59.6	217;51.4	37;16.8	20;41.7	338;54.9	342;39.2	3;21.6
8	6;57.2	79;40.9	217;48.2	37;29.9	21;25.9	338;54.4	344;16.9	3;18.4
9	7;56.0	93;50.4	217;44.8	37;43.0	22;10.1	338;56.1	345;56.3	3;15.3
10	8;54.9	107;38.2	217;41.4	37;56.2	22;54.3	339; .1	347;37.2	3;12.1
11	9;53.7	121;31.0	217;37.9	38; 9.4	23;38.4	339; 6.3	349;19.4	3; 8.9
12	10;52.4	135;28.0	217;34.3	38;22.6	24;22.5	339;14.7	351; 3.0	3; 5.7
13	11;51.2	149; 9.6	217;30.6	38;35.9	25; 6.5	339;25.2	352;47.7	3; 2.5
14	12;49.9	162;25.8	217;26.9	38;49.3	25;50.5	339;37.7	354;33.5	2;59.4
15	13;48.5	175;20.4	217;23.1	39; 2.7	26;34.5	339;52.2	356;20.3	2;56.2
16	14;47.1	188; .3	217;19.2	39;16.1	27;18.4	340; 8.7	358; 8.0	2;53.0
17	15;45.7	200;29.7	217;15.2	39;29.6	28; 2.2	340;27.0	359;56.6	2;49.8
18	16;44.3	212;49.1	217;11.2	39;43.2	28;46.0	340;47.2	1;46.0	2;46.7
19	17;42.8	224;56.5	217; 7.1	39;56.7	29;29.8	341; 9.2	3;36.1	2;43.5
20	18;41.3	236;50.3	217; 2.9	40;10.4	30;13.5	341;32.8	5;26.8	2;40.3
21	19;39.8	248;34.0	216;58.7	40;24.0	30;57.2	341;58.1	7;18.1	2;37.1
22	20;38.2	260;19.2	216;54.4	40;37.7	31;40.8	342;25.0	9; 9.9	2;34.0
23	21;36.6	272;22.9	216;50.1	40;51.4	32;24.4	342;53.4	11; 2.2	2;30.8
24	22;35.0	284;53.8	216;45.7	41; 5.2	33; 8.0	343;23.2	12;55.0	2;27.6
25	23;33.3	297;37.5	216;41.3	41;19.0	33;51.5	343;54.6	14;48.1	2;24.4
26	24;31.6	310;15.7	216;36.8	41;32.8	34;34.9	344;27.2	16;41.5	2;21.2
27	25;29.9	322;52.9	216;32.2	41;46.6	35;18.3	345; 1.2	18;35.1	2;18.1
28	26;28.1	335;44.6	216;27.6	42; .5	36; 1.7	345;36.5	20;29.0	2;14.9
29	27;26.3	348;58.3	216;23.0	42;14.4	36;45.0	346;13.0	22;23.1	2;11.7
30	28;24.5	2;32.5	216;18.3	42;28.3	37;28.3	346;50.6	24;17.4	2; 8.5

MONTH 2

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	29;22.7	16;22.8	216;13.6	42;42.3	38;11.5	347;29.4	26;11.7	2; 5.4
2	30;20.8	30;27.3	216; 8.8	42;56.3	38;54.7	348; 9.3	28; 6.0	2; 2.2
3	31;18.9	44;47.3	216; 4.0	43;10.3	39;37.9	348;50.2	30; .4	1;59.0
4	32;17.0	59;25.9	215;59.2	43;24.3	40;21.0	349;32.1	31;54.7	1;55.8
5	33;15.0	74;22.8	215;54.3	43;38.3	41; 4.0	350;15.0	33;49.0	1;52.6
6	34;13.0	89;27.8	215;49.4	43;52.4	41;47.0	350;58.8	35;43.1	1;49.5
7	35;11.0	104;19.7	215;44.5	44; 6.5	42;30.0	351;43.5	37;37.1	1;46.3
8	36; 8.9	118;38.9	215;39.6	44;20.6	43;12.9	352;29.1	39;30.9	1;43.1
9	37; 6.8	132;23.5	215;34.6	44;34.7	43;55.8	353;15.4	41;24.4	1;39.9
10	38; 4.7	145;51.1	215;29.7	44;48.8	44;38.6	354; 2.6	43;17.6	1;36.8
11	39; 2.6	159;11.3	215;24.7	45; 2.9	45;21.4	354;50.6	45;10.5	1;33.6
12	40; .5	172;15.3	215;19.7	45;17.1	46; 4.1	355;39.3	47; 2.9	1;30.4
13	40;58.3	184;56.5	215;14.7	45;31.2	46;46.8	356;28.7	48;54.9	1;27.2
14	41;56.1	197;19.6	215; 9.7	45;45.4	47;29.5	357;18.8	50;46.5	1;24.0
15	42;53.8	209;32.4	215; 4.6	45;59.6	48;12.1	358; 9.5	52;37.4	1;20.9
16	43;51.6	221;39.6	214;59.6	46;13.7	48;54.7	359; .9	54;27.8	1;17.7
17	44;49.3	233;41.6	214;54.6	46;27.9	49;37.2	359;52.9	56;17.5	1;14.5
18	45;47.0	245;36.4	214;49.6	46;42.1	50;19.6	0;45.5	58; 6.4	1;11.3
19	46;44.7	257;22.0	214;44.6	46;56.3	51; 2.1	1;38.7	59;54.6	1; 8.2
20	47;42.3	269; .2	214;39.6	47;10.5	51;44.5	2;32.4	61;41.8	1; 5.0
21	48;40.0	280;39.2	214;34.6	47;24.7	52;26.8	3;26.6	63;28.1	1; 1.8
22	49;37.6	292;33.5	214;29.6	47;38.9	53; 9.1	4;21.4	65;13.4	0;58.6
23	50;35.2	304;55.2	214;24.7	47;53.1	53;51.3	5;16.6	66;57.6	0;55.5
24	51;32.7	317;42.2	214;19.7	48; 7.2	54;33.5	6;12.4	68;40.5	0;52.3
25	52;30.3	330;39.8	214;14.8	48;21.4	55;15.7	7; 8.5	70;22.1	0;49.1
26	53;27.8	343;44.0	214; 9.9	48;35.6	55;57.8	8; 5.2	72; 2.3	0;45.9
27	54;25.3	357; 5.8	214; 5.1	48;49.8	56;39.9	9; 2.2	73;41.0	0;42.7
28	55;22.8	10;52.1	214; .2	49; 3.9	57;21.9	9;59.7	75;18.0	0;39.6
29	56;20.3	24;59.5	213;55.4	49;18.1	58; 3.9	10;57.6	76;53.3	0;36.4
30	57;17.7	39;20.8	213;50.7	49;32.2	58;45.9	11;55.8	78;26.6	0;33.2

MONTH 3

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	58;15.2	53;51.4	213;46.0	49;46.3	59;27.8	12;54.5	79;57.8	0;30.0
2	59;12.6	68;30.8	213;41.3	50; .4	60; 9.6	13;53.5	81;26.8	0;26.9
3	60;10.0	83;20.1	213;36.6	50;14.5	60;51.4	14;52.9	82;53.4	0;23.7
4	61; 7.4	98;17.9	213;32.0	50;28.6	61;33.2	15;52.6	84;17.4	0;20.5
5	62; 4.7	113;15.4	213;27.5	50;42.7	62;14.9	16;52.6	85;38.5	0;17.3
6	63; 2.1	127;57.1	213;23.0	50;56.7	62;56.6	17;52.9	86;56.6	0;14.1
7	63;59.4	142; 9.3	213;18.5	51;10.7	63;38.3	18;53.6	88;11.4	0;11.0
8	64;56.8	155;50.0	213;14.1	51;24.7	64;19.8	19;54.6	89;22.7	0; 7.8
9	65;54.1	169; 6.3	213; 9.8	51;38.7	65; 1.4	20;55.8	90;30.2	0; 4.6
10	66;51.4	182; 3.8	213; 5.5	51;52.7	65;42.9	21;57.4	91;33.5	0; 1.4
11	67;48.6	194;40.1	213; 1.3	52; 6.6	66;24.4	22;59.2	92;32.5	359;58.3
12	68;45.9	206;54.0	212;57.1	52;20.5	67; 5.8	24; 1.3	93;26.7	359;55.1
13	69;43.2	218;52.5	212;53.0	52;34.4	67;47.2	25; 3.6	94;15.8	359;51.9
14	70;40.4	230;45.0	212;49.0	52;48.3	68;28.5	26; 6.2	94;59.4	359;48.7
15	71;37.7	242;36.9	212;45.0	53; 2.1	69; 9.8	27; 9.1	95;37.2	359;45.6
16	72;34.9	254;28.8	212;41.1	53;15.9	69;51.1	28;12.2	96; 8.9	359;42.4
17	73;32.1	266;18.7	212;37.3	53;29.6	70;32.3	29;15.5	96;33.9	359;39.2
18	74;29.3	278; 4.4	212;33.5	53;43.4	71;13.5	30;19.0	96;52.1	359;36.0
19	75;26.5	289;46.4	212;29.9	53;57.1	71;54.6	31;22.8	97; 2.9	359;32.8
20	76;23.7	301;30.6	212;26.3	54;10.7	72;35.7	32;26.8	97; 6.2	359;29.7
21	77;20.9	313;28.1	212;22.7	54;24.3	73;16.7	33;31.0	97; 1.8	359;26.5
22	78;18.1	325;49.4	212;19.3	54;37.9	73;57.7	34;35.3	96;49.4	359;23.3
23	79;15.3	338;36.8	212;16.0	54;51.5	74;38.7	35;39.9	96;29.1	359;20.1
24	80;12.4	351;44.9	212;12.7	55; 5.0	75;19.6	36;44.7	96; 1.0	359;17.0
25	81; 9.6	5;11.1	212; 9.5	55;18.4	76; .5	37;49.7	95;25.3	359;13.8
26	82; 6.7	19; 1.2	212; 6.4	55;31.8	76;41.3	38;54.8	94;42.5	359;10.6
27	83; 3.9	33;18.8	212; 3.4	55;45.2	77;22.1	40; .2	93;53.3	359; 7.4
28	84; 1.0	47;56.4	212; .5	55;58.5	78; 2.9	41; 5.7	92;58.5	359; 4.2
29	84;58.2	62;42.6	211;57.7	56;11.8	78;43.6	42;11.3	91;59.1	359; 1.1
30	85;55.3	77;29.6	211;54.9	56;25.0	79;24.3	43;17.2	90;56.5	358;57.9

MONTH 4

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	86;52.5	92;15.6	211;52.3	56;38.2	80; 4.9	44;23.2	89;51.9	358;54.7
2	87;49.6	107; 1.0	211;49.7	56;51.3	80;45.5	45;29.3	88;46.8	358;51.5
3	88;46.8	121;44.5	211;47.3	57; 4.4	81;26.0	46;35.7	87;42.8	358;48.4
4	89;43.9	136;19.8	211;44.9	57;17.4	82; 6.6	47;42.1	86;41.1	358;45.2
5	90;41.0	150;36.4	211;42.7	57;30.3	82;47.0	48;48.8	85;43.2	358;42.0
6	91;38.2	164;26.5	211;40.5	57;43.2	83;27.5	49;55.5	84;50.1	358;38.8
7	92;35.3	177;52.6	211;38.4	57;56.1	84; 7.9	51; 2.4	84; 3.0	358;35.7
8	93;32.4	191; 2.0	211;36.5	58; 8.9	84;48.2	52; 9.5	83;22.6	358;32.5
9	94;29.6	203;52.4	211;34.6	58;21.6	85;28.5	53;16.6	82;49.5	358;29.3
10	95;26.7	216;16.9	211;32.9	58;34.2	86; 8.8	54;24.0	82;24.0	358;26.1
11	96;23.9	228;16.0	211;31.2	58;46.8	86;49.0	55;31.4	82; 6.4	358;22.9
12	97;21.0	239;59.9	211;29.7	58;59.4	87;29.2	56;39.0	81;56.8	358;19.8
13	98;18.2	251;40.3	211;28.2	59;11.8	88; 9.4	57;46.7	81;55.1	358;16.6
14	99;15.3	263;24.7	211;26.9	59;24.2	88;49.5	58;54.5	82; 1.1	358;13.4
15	100;12.5	275;14.2	211;25.6	59;36.5	89;29.6	60; 2.4	82;14.5	358;10.2
16	101; 9.7	287; 6.9	211;24.5	59;48.8	90; 9.6	61;10.5	82;35.1	358; 7.1
17	102; 6.9	299; .7	211;23.5	60; .9	90;49.6	62;18.7	83; 2.5	358; 3.9
18	103; 4.0	310;55.4	211;22.6	60;13.0	91;29.5	63;27.0	83;36.3	358; .7
19	104; 1.2	322;55.7	211;21.7	60;25.1	92; 9.5	64;35.4	84;16.2	357;57.5
20	104;58.4	335;10.4	211;21.0	60;37.0	92;49.3	65;43.9	85; 1.8	357;54.3
21	105;55.6	347;46.7	211;20.4	60;48.9	93;29.2	66;52.5	85;52.7	357;51.2
22	106;52.8	0;43.9	211;19.9	61; .6	94; 9.0	68; 1.3	86;48.5	357;48.0
23	107;50.1	13;58.6	211;19.6	61;12.3	94;48.7	69;10.1	87;49.0	357;44.8
24	108;47.3	27;36.2	211;19.3	61;24.0	95;28.5	70;19.0	88;53.7	357;41.6
25	109;44.6	41;45.6	211;19.1	61;35.5	96; 8.2	71;28.1	90; 2.4	357;38.5
26	110;41.8	56;26.4	211;19.0	61;46.9	96;47.8	72;37.2	91;14.8	357;35.3
27	111;39.1	71;25.2	211;19.1	61;58.3	97;27.4	73;46.4	92;30.6	357;32.1
28	112;36.4	86;24.9	211;19.2	62; 9.6	98; 7.0	74;55.8	93;49.5	357;28.9
29	113;33.7	101;15.2	211;19.5	62;20.7	98;46.5	76; 5.2	95;11.4	357;25.8
30	114;31.0	115;53.9	211;19.9	62;31.8	99;26.0	77;14.7	96;35.9	357;22.6

MONTH 5

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	115;28.3	130;22.3	211;20.3	62;42.8	100; 5.5	78;24.3	98; 2.9	357;19.4
2	116;25.6	144;40.7	211;20.9	62;53.7	100;44.9	79;34.1	99;32.2	357;16.2
3	117;23.0	158;45.5	211;21.6	63; 4.5	101;24.3	80;43.8	101; 3.6	357;13.0
4	118;20.3	172;30.1	211;22.4	63;15.1	102; 3.6	81;53.7	102;36.9	357; 9.9
5	119;17.7	185;50.5	211;23.3	63;25.7	102;43.0	83; 3.7	104;12.1	357; 6.7
6	120;15.1	198;52.3	211;24.3	63;36.2	103;22.2	84;13.8	105;48.8	357; 3.5
7	121;12.5	211;47.8	211;25.4	63;46.6	104; 1.5	85;23.9	107;27.1	357; .3
8	122; 9.9	224;36.9	211;26.7	63;56.9	104;40.7	86;34.1	109; 6.7	356;57.2
9	123; 7.4	237; 4.0	211;28.0	64; 7.0	105;19.8	87;44.4	110;47.6	356;54.0
10	124; 4.8	249; 2.6	211;29.4	64;17.1	105;59.0	88;54.8	112;29.7	356;50.8
11	125; 2.3	260;43.2	211;31.0	64;27.0	106;38.0	90; 5.3	114;12.8	356;47.6
12	125;59.8	272;21.0	211;32.6	64;36.8	107;17.1	91;15.9	115;56.8	356;44.4
13	126;57.3	284; 5.9	211;34.3	64;46.6	107;56.1	92;26.5	117;41.7	356;41.3
14	127;54.9	296; .8	211;36.2	64;56.2	108;35.1	93;37.2	119;27.4	356;38.1
15	128;52.4	308; 4.0	211;38.1	65; 5.6	109;14.0	94;48.0	121;13.8	356;34.9
16	129;50.0	320;13.5	211;40.2	65;15.0	109;52.9	95;58.8	123; .7	356;31.7
17	130;47.6	332;29.0	211;42.3	65;24.2	110;31.8	97; 9.8	124;48.2	356;28.6
18	131;45.2	344;54.6	211;44.6	65;33.3	111;10.6	98;20.8	126;36.2	356;25.4
19	132;42.9	357;37.8	211;46.9	65;42.3	111;49.4	99;31.9	128;24.6	356;22.2
20	133;40.6	10;44.0	211;49.4	65;51.2	112;28.2	100;43.0	130;13.3	356;19.0
21	134;38.3	24; 7.9	211;51.9	65;59.9	113; 6.9	101;54.3	132; 2.2	356;15.9
22	135;36.0	37;37.7	211;54.5	66; 8.5	113;45.6	103; 5.6	133;51.4	356;12.7
23	136;33.7	51;19.0	211;57.3	66;17.0	114;24.3	104;16.9	135;40.7	356; 9.5
24	137;31.5	65;32.0	212; .1	66;25.3	115; 2.9	105;28.4	137;30.1	356; 6.3
25	138;29.2	80;19.9	212; 3.1	66;33.5	115;41.5	106;39.9	139;19.5	356; 3.1
26	139;27.1	95;23.9	212; 6.1	66;41.5	116;20.0	107;51.4	141; 8.9	355;60.0
27	140;24.9	110;21.5	212; 9.2	66;49.4	116;58.5	109; 3.1	142;58.2	355;56.8
28	141;22.8	125; .2	212;12.4	66;57.2	117;37.0	110;14.8	144;47.4	355;53.6
29	142;20.6	139;18.9	212;15.7	67; 4.9	118;15.4	111;26.6	146;36.4	355;50.4
30	143;18.6	153;20.8	212;19.1	67;12.3	118;53.8	112;38.4	148;25.2	355;47.3

MONTH 6

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	144;16.5	167; 8.2	212;22.6	67;19.7	119;32.2	113;50.3	150;13.7	355;44.1
2	145;14.5	180;39.8	212;26.2	67;26.9	120;10.5	115; 2.3	152; 1.8	355;40.9
3	146;12.5	193;51.8	212;29.8	67;33.9	120;48.8	116;14.3	153;49.6	355;37.7
4	147;10.5	206;41.9	212;33.6	67;40.8	121;27.1	117;26.4	155;36.9	355;34.5
5	148; 8.5	219;16.1	212;37.4	67;47.5	122; 5.3	118;38.6	157;23.7	355;31.4
6	149; 6.6	231;49.5	212;41.3	67;54.1	122;43.5	119;50.8	159; 9.9	355;28.2
7	150; 4.7	244;31.3	212;45.4	68; .5	123;21.7	121; 3.1	160;55.5	355;25.0
8	151; 2.9	257; 6.7	212;49.5	68; 6.8	123;59.8	122;15.4	162;40.5	355;21.8
9	152; 1.0	269;16.7	212;53.6	68;12.9	124;37.9	123;27.9	164;24.7	355;18.7
10	152;59.2	281; 5.6	212;57.9	68;18.8	125;15.9	124;40.3	166; 8.1	355;15.5
11	153;57.5	292;50.3	213; 2.2	68;24.6	125;53.9	125;52.8	167;50.7	355;12.3
12	154;55.7	304;44.2	213; 6.6	68;30.2	126;31.9	127; 5.4	169;32.3	355; 9.1
13	155;54.0	316;52.1	213;11.1	68;35.7	127; 9.9	128;18.1	171;12.9	355; 5.9
14	156;52.4	329;13.1	213;15.7	68;41.0	127;47.8	129;30.8	172;52.5	355; 2.8
15	157;50.7	341;45.1	213;20.4	68;46.1	128;25.6	130;43.5	174;30.9	354;59.6
16	158;49.1	354;27.9	213;25.1	68;51.0	129; 3.5	131;56.3	176; 8.1	354;56.4
17	159;47.5	7;25.2	213;29.9	68;55.8	129;41.3	133; 9.2	177;44.0	354;53.2
18	160;46.0	20;43.6	213;34.8	69; .3	130;19.0	134;22.1	179;18.4	354;50.1
19	161;44.4	34;27.7	213;39.7	69; 4.8	130;56.8	135;35.1	180;51.5	354;46.9
20	162;43.0	48;30.0	213;44.8	69; 9.0	131;34.5	136;48.2	182;22.9	354;43.7
21	163;41.5	62;29.7	213;49.9	69;13.0	132;12.1	138; 1.3	183;52.6	354;40.5
22	164;40.1	76;18.9	213;55.0	69;16.9	132;49.8	139;14.4	185;20.6	354;37.4
23	165;38.7	90;21.5	214; .3	69;20.6	133;27.3	140;27.6	186;46.7	354;34.2
24	166;37.4	104;55.4	214; 5.6	69;24.1	134; 4.9	141;40.9	188;10.7	354;31.0
25	167;36.0	119;44.5	214;10.9	69;27.4	134;42.4	142;54.2	189;32.6	354;27.8
26	168;34.8	134;22.5	214;16.4	69;30.6	135;19.9	144; 7.5	190;52.3	354;24.6
27	169;33.5	148;36.0	214;21.9	69;33.5	135;57.3	145;20.9	192; 9.5	354;21.5
28	170;32.3	162;25.1	214;27.4	69;36.3	136;34.7	146;34.4	193;24.1	354;18.3
29	171;31.1	175;55.3	214;33.0	69;38.9	137;12.1	147;47.9	194;36.0	354;15.1
30	172;30.0	189;10.1	214;38.7	69;41.2	137;49.5	149; 1.5	195;45.1	354;11.9

MONTH 7

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	173;28.9	202;10.1	214;44.5	69;43.4	138;26.8	150;15.1	196;51.1	354; 8.8
2	174;27.8	214;52.7	214;50.3	69;45.4	139; 4.0	151;28.7	197;53.8	354; 5.6
3	175;26.7	227;16.3	214;56.1	69;47.2	139;41.3	152;42.4	198;53.2	354; 2.4
4	176;25.7	239;25.6	215; 2.1	69;48.9	140;18.4	153;56.2	199;48.9	353;59.2
5	177;24.8	251;35.0	215; 8.0	69;50.3	140;55.6	155;10.0	200;40.9	353;56.0
6	178;23.8	264; .5	215;14.1	69;51.5	141;32.7	156;23.9	201;28.9	353;52.9
7	179;22.9	276;38.8	215;20.2	69;52.5	142; 9.8	157;37.8	202;12.7	353;49.7
8	180;22.1	289; 5.8	215;26.3	69;53.4	142;46.9	158;51.7	202;52.1	353;46.5
9	181;21.2	301;12.5	215;32.5	69;54.0	143;23.9	160; 5.7	203;27.0	353;43.3
10	182;20.5	313;13.1	215;38.7	69;54.4	144; .8	161;19.7	203;57.1	353;40.2
11	183;19.7	325;23.9	215;45.0	69;54.7	144;37.8	162;33.8	204;22.4	353;37.0
12	184;19.0	337;52.2	215;51.3	69;54.7	145;14.7	163;48.0	204;42.6	353;33.8
13	185;18.3	350;37.6	215;57.7	69;54.6	145;51.5	165; 2.1	204;57.6	353;30.6
14	186;17.7	3;37.7	216; 4.1	69;54.2	146;28.4	166;16.3	205; 7.4	353;27.5
15	187;17.0	16;52.0	216;10.6	69;53.7	147; 5.2	167;30.6	205;12.0	353;24.3
16	188;16.5	30;23.3	216;17.1	69;52.9	147;41.9	168;44.9	205;11.4	353;21.1
17	189;15.9	44;17.6	216;23.7	69;52.0	148;18.6	169;59.3	205; 5.7	353;17.9
18	190;15.4	58;38.1	216;30.3	69;50.8	148;55.3	171;13.7	204;55.0	353;14.7
19	191;14.9	73;17.0	216;36.9	69;49.5	149;31.9	172;28.1	204;39.5	353;11.6
20	192;14.5	87;50.6	216;43.6	69;47.9	150; 8.5	173;42.6	204;19.7	353; 8.4
21	193;14.1	101;57.7	216;50.3	69;46.2	150;45.1	174;57.1	203;55.9	353; 5.2
22	194;13.8	115;49.4	216;57.1	69;44.3	151;21.6	176;11.6	203;28.6	353; 2.0
23	195;13.4	129;54.2	217; 3.9	69;42.2	151;58.1	177;26.2	202;58.5	352;58.9
24	196;13.1	144;10.4	217;10.7	69;39.8	152;34.5	178;40.9	202;26.1	352;55.7
25	197;12.9	158;14.8	217;17.6	69;37.3	153;10.9	179;55.5	201;52.1	352;52.5
26	198;12.7	171;53.8	217;24.4	69;34.6	153;47.3	181;10.2	201;17.3	352;49.3
27	199;12.5	185; 8.6	217;31.4	69;31.8	154;23.6	182;25.0	200;42.6	352;46.1
28	200;12.3	198; 5.8	217;38.3	69;28.7	154;59.9	183;39.8	200; 8.5	352;43.0
29	201;12.2	210;50.1	217;45.3	69;25.4	155;36.1	184;54.6	199;36.0	352;39.8
30	202;12.1	223;22.6	217;52.3	69;22.0	156;12.3	186; 9.4	199; 5.6	352;36.6

MONTH 8

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	203;12.1	235;41.5	217;59.3	69;18.4	156;48.5	187;24.3	198;38.1	352;33.4
2	204;12.1	247;44.9	218; 6.4	69;14.5	157;24.6	188;39.3	198;14.0	352;30.3
3	205;12.1	259;35.8	218;13.5	69;10.6	158; .7	189;54.2	197;53.8	352;27.1
4	206;12.1	271;25.7	218;20.6	69; 6.4	158;36.7	191; 9.2	197;37.9	352;23.9
5	207;12.2	283;32.0	218;27.7	69; 2.1	159;12.7	192;24.3	197;26.6	352;20.7
6	208;12.4	296; 3.4	218;34.9	68;57.6	159;48.7	193;39.3	197;20.3	352;17.6
7	209;12.5	308;43.5	218;42.0	68;52.9	160;24.6	194;54.4	197;18.9	352;14.4
8	210;12.7	321;12.9	218;49.2	68;48.1	161; .5	196; 9.5	197;22.7	352;11.2
9	211;12.9	333;36.6	218;56.4	68;43.1	161;36.3	197;24.7	197;31.6	352; 8.0
10	212;13.2	346;11.3	219; 3.7	68;37.9	162;12.1	198;39.9	197;45.7	352; 4.8
11	213;13.5	359; 6.2	219;10.9	68;32.6	162;47.8	199;55.1	198; 4.8	352; 1.7
12	214;13.8	12;21.4	219;18.2	68;27.1	163;23.5	201;10.4	198;28.8	351;58.5
13	215;14.1	25;53.3	219;25.4	68;21.5	163;59.1	202;25.6	198;57.6	351;55.3
14	216;14.5	39;40.1	219;32.7	68;15.7	164;34.7	203;40.9	199;31.1	351;52.1
15	217;14.9	53;43.7	219;40.0	68; 9.8	165;10.3	204;56.3	200; 9.0	351;49.0
16	218;15.3	68; 7.9	219;47.3	68; 3.8	165;45.8	206;11.6	200;51.2	351;45.8
17	219;15.8	82;54.5	219;54.6	67;57.6	166;21.3	207;27.0	201;37.4	351;42.6
18	220;16.3	97;55.5	220; 1.9	67;51.3	166;56.7	208;42.5	202;27.6	351;39.4
19	221;16.8	112;49.7	220; 9.3	67;44.8	167;32.0	209;57.9	203;21.4	351;36.2
20	222;17.4	127;13.4	220;16.6	67;38.3	168; 7.4	211;13.4	204;18.8	351;33.1
21	223;18.0	141; 3.3	220;23.9	67;31.6	168;42.6	212;28.9	205;19.4	351;29.9
22	224;18.6	154;41.0	220;31.3	67;24.8	169;17.8	213;44.4	206;23.3	351;26.7
23	225;19.2	168;18.6	220;38.6	67;17.9	169;53.0	214;59.9	207;30.0	351;23.5
24	226;19.9	181;43.8	220;45.9	67;10.9	170;28.1	216;15.5	208;39.6	351;20.4
25	227;20.6	194;45.7	220;53.3	67; 3.9	171; 3.2	217;31.1	209;51.8	351;17.2
26	228;21.3	207;26.4	221; .6	66;56.7	171;38.2	218;46.7	211; 6.5	351;14.0
27	229;22.1	219;53.3	221; 8.0	66;49.4	172;13.2	220; 2.3	212;23.5	351;10.8
28	230;22.8	232;11.6	221;15.3	66;42.0	172;48.1	221;18.0	213;42.7	351; 7.7
29	231;23.6	244;22.6	221;22.6	66;34.6	173;23.0	222;33.6	215; 4.0	351; 4.5
30	232;24.4	256;24.5	221;29.9	66;27.1	173;57.8	223;49.3	216;27.3	351; 1.3

MONTH 9

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	233;25.3	268;15.2	221;37.3	66;19.5	174;32.6	225; 5.0	217;52.4	350;58.1
2	234;26.1	279;56.1	221;44.6	66;11.9	175; 7.3	226;20.7	219;19.2	350;54.9
3	235;27.0	291;35.3	221;51.9	66; 4.2	175;41.9	227;36.5	220;47.7	350;51.8
4	236;27.9	303;28.0	221;59.2	65;56.5	176;16.5	228;52.2	222;17.6	350;48.6
5	237;28.9	315;47.8	222; 6.4	65;48.7	176;51.0	230; 8.0	223;49.0	350;45.4
6	238;29.8	328;31.6	222;13.7	65;40.9	177;25.5	231;23.8	225;21.7	350;42.2
7	239;30.8	341;21.3	222;21.0	65;33.1	177;59.9	232;39.6	226;55.7	350;39.1
8	240;31.8	354;11.5	222;28.2	65;25.2	178;34.3	233;55.4	228;30.9	350;35.9
9	241;32.8	7;14.8	222;35.4	65;17.3	179; 8.6	235;11.3	230; 7.2	350;32.7
10	242;33.8	20;40.9	222;42.6	65; 9.4	179;42.8	236;27.1	231;44.5	350;29.5
11	243;34.9	34;29.0	222;49.8	65; 1.5	180;17.0	237;43.0	233;22.8	350;26.3
12	244;35.9	48;33.4	222;57.0	64;53.6	180;51.1	238;58.8	235; 1.9	350;23.2
13	245;37.0	62;50.3	223; 4.1	64;45.7	181;25.1	240;14.7	236;42.0	350;20.0
14	246;38.1	77;19.3	223;11.2	64;37.8	181;59.1	241;30.6	238;22.7	350;16.8
15	247;39.2	92; 2.4	223;18.3	64;29.9	182;33.1	242;46.5	240; 4.2	350;13.6
16	248;40.4	106;59.6	223;25.4	64;22.1	183; 6.9	244; 2.4	241;46.4	350;10.5
17	249;41.5	122; 3.4	223;32.5	64;14.2	183;40.7	245;18.3	243;29.2	350; 7.3
18	250;42.7	136;56.8	223;39.5	64; 6.5	184;14.4	246;34.3	245;12.5	350; 4.1
19	251;43.8	151;21.4	223;46.5	63;58.7	184;48.1	247;50.2	246;56.3	350; .9
20	252;45.0	165;11.2	223;53.5	63;51.0	185;21.6	249; 6.1	248;40.5	349;57.8
21	253;46.2	178;35.0	224; .4	63;43.3	185;55.2	250;22.1	250;25.2	349;54.6
22	254;47.4	191;43.9	224; 7.3	63;35.7	186;28.6	251;38.0	252;10.2	349;51.4
23	255;48.6	204;35.7	224;14.2	63;28.2	187; 1.9	252;54.0	253;55.5	349;48.2
24	256;49.8	217; 5.4	224;21.1	63;20.7	187;35.2	254;10.0	255;41.1	349;45.0
25	257;51.1	229;17.0	224;27.9	63;13.3	188; 8.4	255;25.9	257;26.8	349;41.9
26	258;52.3	241;19.2	224;34.7	63; 6.0	188;41.6	256;41.9	259;12.8	349;38.7
27	259;53.6	253;17.8	224;41.4	62;58.8	189;14.6	257;57.8	260;58.8	349;35.5
28	260;54.8	265;14.2	224;48.1	62;51.6	189;47.6	259;13.8	262;44.9	349;32.3
29	261;56.1	277; 6.5	224;54.8	62;44.6	190;20.5	260;29.8	264;30.9	349;29.2
30	262;57.4	288;52.5	225; 1.4	62;37.6	190;53.3	261;45.8	266;16.9	349;26.0

MONTH 10

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	263;58.6	300;32.3	225; 8.0	62;30.8	191;26.0	263; 1.7	268; 2.9	349;22.8
2	264;59.9	312;11.5	225;14.6	62;24.0	191;58.7	264;17.7	269;48.6	349;19.6
3	266; 1.2	324; 1.9	225;21.1	62;17.4	192;31.2	265;33.7	271;34.2	349;16.4
4	267; 2.5	336;16.1	225;27.5	62;10.9	193; 3.7	266;49.6	273;19.5	349;13.3
5	268; 3.8	348;58.0	225;33.9	62; 4.5	193;36.1	268; 5.6	275; 4.4	349;10.1
6	269; 5.0	1;59.6	225;40.3	61;58.3	194; 8.4	269;21.5	276;49.0	349; 6.9
7	270; 6.3	15;13.6	225;46.6	61;52.1	194;40.6	270;37.5	278;33.0	349; 3.7
8	271; 7.6	28;46.1	225;52.9	61;46.1	195;12.7	271;53.4	280;16.6	349; .6
9	272; 8.9	42;44.4	225;59.1	61;40.3	195;44.7	273; 9.4	281;59.6	348;57.4
10	273;10.2	57; 5.1	226; 5.3	61;34.6	196;16.6	274;25.3	283;41.8	348;54.2
11	274;11.5	71;39.0	226;11.4	61;29.0	196;48.4	275;41.2	285;23.3	348;51.0
12	275;12.7	86;18.9	226;17.5	61;23.6	197;20.1	276;57.1	287; 4.0	348;47.8
13	276;14.0	101; 2.7	226;23.5	61;18.3	197;51.6	278;13.0	288;43.8	348;44.7
14	277;15.3	115;50.8	226;29.5	61;13.2	198;23.1	279;28.9	290;22.4	348;41.5
15	278;16.6	130;42.5	226;35.4	61; 8.3	198;54.5	280;44.8	292; .0	348;38.3
16	279;17.8	145;31.6	226;41.2	61; 3.5	199;25.8	282; .7	293;36.3	348;35.1
17	280;19.1	160; 6.0	226;47.0	60;58.9	199;56.9	283;16.6	295;11.3	348;32.0
18	281;20.3	174;13.8	226;52.8	60;54.5	200;28.0	284;32.4	296;44.7	348;28.8
19	282;21.6	187;53.2	226;58.4	60;50.2	200;58.9	285;48.3	298;16.5	348;25.6
20	283;22.8	201;10.3	227; 4.1	60;46.1	201;29.7	287; 4.1	299;46.6	348;22.4
21	284;24.0	214; 6.9	227; 9.6	60;42.2	202; .4	288;19.9	301;14.7	348;19.3
22	285;25.2	226;39.9	227;15.1	60;38.4	202;30.9	289;35.7	302;40.7	348;16.1
23	286;26.4	238;48.5	227;20.5	60;34.9	203; 1.4	290;51.5	304; 4.4	348;12.9
24	287;27.6	250;40.0	227;25.9	60;31.5	203;31.7	292; 7.3	305;25.7	348; 9.7
25	288;28.8	262;25.3	227;31.2	60;28.3	204; 1.8	293;23.1	306;44.3	348; 6.5
26	289;29.9	274;11.5	227;36.4	60;25.3	204;31.9	294;38.8	307;59.9	348; 3.4
27	290;31.1	286; .8	227;41.5	60;22.5	205; 1.8	295;54.5	309;12.4	348; .2
28	291;32.2	297;51.3	227;46.6	60;19.8	205;31.5	297;10.2	310;21.5	347;57.0
29	292;33.4	309;40.6	227;51.6	60;17.4	206; 1.1	298;25.9	311;26.9	347;53.8
30	293;34.5	321;28.3	227;56.5	60;15.1	206;30.6	299;41.6	312;28.3	347;50.7

MONTH 11

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	294;35.6	333;18.3	228; 1.4	60;13.0	206;59.9	300;57.2	313;25.4	347;47.5
2	295;36.6	345;19.7	228; 6.2	60;11.2	207;29.1	302;12.9	314;17.9	347;44.3
3	296;37.7	357;42.1	228;10.9	60; 9.5	207;58.1	303;28.5	315; 5.3	347;41.1
4	297;38.7	10;28.3	228;15.6	60; 8.0	208;26.9	304;44.1	315;47.4	347;37.9
5	298;39.8	23;35.6	228;20.1	60; 6.7	208;55.6	305;59.6	316;23.8	347;34.8
6	299;40.8	37; 4.3	228;24.6	60; 5.6	209;24.1	307;15.2	316;54.1	347;31.6
7	300;41.7	51; .2	228;29.0	60; 4.7	209;52.5	308;30.7	317;17.8	347;28.4
8	301;42.7	65;26.2	228;33.3	60; 4.0	210;20.7	309;46.2	317;34.8	347;25.2
9	302;43.7	80;13.9	228;37.6	60; 3.5	210;48.6	311; 1.7	317;44.5	347;22.1
10	303;44.6	95; 9.0	228;41.7	60; 3.2	211;16.5	312;17.1	317;46.8	347;18.9
11	304;45.5	110; .8	228;45.8	60; 3.1	211;44.1	313;32.6	317;41.4	347;15.7
12	305;46.4	124;46.0	228;49.8	60; 3.2	212;11.5	314;48.0	317;28.1	347;12.5
13	306;47.2	139;25.0	228;53.7	60; 3.5	212;38.7	316; 3.4	317; 6.9	347; 9.4
14	307;48.0	153;57.8	228;57.5	60; 3.9	213; 5.8	317;18.7	316;38.0	347; 6.2
15	308;48.9	168;20.6	229; 1.3	60; 4.6	213;32.6	318;34.0	316; 1.5	347; 3.0
16	309;49.6	182;25.3	229; 4.9	60; 5.5	213;59.2	319;49.3	315;18.0	346;59.8
17	310;50.4	196; 5.2	229; 8.5	60; 6.5	214;25.6	321; 4.6	314;28.0	346;56.6
18	311;51.1	209;22.6	229;12.0	60; 7.8	214;51.8	322;19.8	313;32.5	346;53.5
19	312;51.8	222;27.6	229;15.3	60; 9.2	215;17.8	323;35.0	312;32.6	346;50.3
20	313;52.5	235;21.2	229;18.6	60;10.8	215;43.5	324;50.2	311;29.3	346;47.1
21	314;53.2	247;51.4	229;21.8	60;12.7	216; 9.0	326; 5.4	310;24.1	346;43.9
22	315;53.8	259;53.3	229;24.9	60;14.7	216;34.3	327;20.5	309;18.5	346;40.8
23	316;54.4	271;36.1	229;27.9	60;16.9	216;59.3	328;35.6	308;13.9	346;37.6
24	317;55.0	283;13.6	229;30.8	60;19.3	217;24.1	329;50.7	307;11.8	346;34.4
25	318;55.5	294;55.7	229;33.7	60;21.9	217;48.6	331; 5.7	306;13.4	346;31.2
26	319;56.1	306;45.6	229;36.4	60;24.6	218;12.8	332;20.7	305;20.0	346;28.0
27	320;56.5	318;42.0	229;39.0	60;27.6	218;36.8	333;35.7	304;32.6	346;24.9
28	321;57.0	330;42.5	229;41.5	60;30.7	219; .4	334;50.6	303;51.9	346;21.7
29	322;57.4	342;46.4	229;44.0	60;34.1	219;23.8	336; 5.5	303;18.6	346;18.5
30	323;57.8	354;57.0	229;46.3	60;37.6	219;47.0	337;20.4	302;53.0	346;15.3

MONTH 12

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	324;58.2	7;21.6	229;48.5	60;41.2	220; 9.8	338;35.2	302;35.4	346;12.2
2	325;58.5	20; 7.7	229;50.7	60;45.1	220;32.3	339;50.0	302;25.9	346; 9.0
3	326;58.8	33;13.9	229;52.7	60;49.1	220;54.5	341; 4.7	302;24.3	346; 5.8
4	327;59.1	46;32.4	229;54.6	60;53.4	221;16.4	342;19.5	302;30.4	346; 2.6
5	328;59.3	60; 7.2	229;56.5	60;57.8	221;37.9	343;34.2	302;44.1	345;59.5
6	329;59.5	74;13.4	229;58.2	61; 2.3	221;59.1	344;48.8	303; 5.1	345;56.3
7	330;59.7	88;54.6	229;59.8	61; 7.1	222;20.0	346; 3.4	303;32.9	345;53.1
8	331;59.9	103;56.9	230; 1.3	61;12.0	222;40.5	347;18.0	304; 7.2	345;49.9
9	332;60.0	118;59.5	230; 2.8	61;17.0	223; .6	348;32.6	304;47.7	345;46.7
10	334; .0	133;48.8	230; 4.1	61;22.3	223;20.4	349;47.1	305;33.9	345;43.6
11	335; .1	148;21.6	230; 5.3	61;27.7	223;39.8	351; 1.5	306;25.5	345;40.4
12	336; .1	162;39.6	230; 6.4	61;33.3	223;58.8	352;16.0	307;22.2	345;37.2
13	337; .1	176;44.7	230; 7.4	61;39.0	224;17.4	353;30.4	308;23.5	345;34.0
14	338; .0	190;35.4	230; 8.3	61;44.9	224;35.6	354;44.7	309;29.2	345;30.9
15	338;59.9	204; 7.0	230; 9.0	61;51.0	224;53.4	355;59.0	310;38.9	345;27.7
16	339;59.8	217;15.6	230; 9.7	61;57.2	225;10.7	357;13.3	311;52.3	345;24.5
17	340;59.6	230; 5.1	230;10.3	62; 3.5	225;27.6	358;27.5	313; 9.3	345;21.3
18	341;59.4	242;49.1	230;10.8	62;10.1	225;44.1	359;41.7	314;29.5	345;18.1
19	342;59.2	255;36.1	230;11.1	62;16.7	226; .0	0;55.9	315;52.6	345;15.0
20	343;58.9	268;12.2	230;11.4	62;23.6	226;15.6	2;10.0	317;18.6	345;11.8
21	344;58.6	280;21.2	230;11.5	62;30.5	226;30.6	3;24.1	318;47.1	345; 8.6
22	345;58.3	292; 7.4	230;11.5	62;37.7	226;45.1	4;38.1	320;17.9	345; 5.4
23	346;57.9	303;47.2	230;11.5	62;44.9	226;59.1	5;52.1	321;51.0	345; 2.3
24	347;57.5	315;33.6	230;11.3	62;52.3	227;12.6	7; 6.0	323;26.1	344;59.1
25	348;57.1	327;32.0	230;11.0	62;59.9	227;25.6	8;19.9	325; 3.1	344;55.9
26	349;56.6	339;41.8	230;10.6	63; 7.6	227;38.0	9;33.8	326;41.8	344;52.7
27	350;56.1	352; .7	230;10.1	63;15.4	227;49.9	10;47.6	328;22.1	344;49.6
28	351;55.5	4;28.0	230; 9.5	63;23.4	228; 1.2	12; 1.3	330; 3.9	344;46.4
29	352;54.9	17; 6.8	230; 8.8	63;31.5	228;11.9	13;15.1	331;47.1	344;43.2
30	353;54.3	30; 3.6	230; 8.0	63;39.7	228;22.0	14;28.7	333;31.5	344;40.0

MONTH 13

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE
1	354;53.6	43;24.5	230; 7.0	63;48.1	228;31.5	15;42.4	335;17.1	344;36.8
2	355;52.9	57; 5.8	230; 6.0	63;56.6	228;40.4	16;56.0	337; 3.8	344;33.7
3	356;52.2	70;50.8	230; 4.9	64; 5.2	228;48.6	18; 9.5	338;51.5	344;30.5
4	357;51.4	84;33.3	230; 3.6	64;13.9	228;56.2	19;23.0	340;40.0	344;27.3
5	358;50.6	98;35.3	230; 2.3	64;22.8	229; 3.2	20;36.5	342;29.4	344;24.1
6	359;49.8	113;12.3	230; .8	64;31.8	229; 9.4	21;49.9	344;19.5	344;21.0
7	0;48.9	128;10.1	229;59.3	64;40.9	229;15.0	23; 3.2	346;10.3	344;17.8

MONTH 1

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♓		△ 2.1 ♁			☿ 7.5 ♁			
2	5.7 ☌	♓	☿ 8.7 ☌							
3		♈							☿ .2 ♁	
4	9.6 ☌	♈				☿ 2.5 ♁				
5		♉		− 10.9 ♁	☿ 9.5 ♁		♒ 3.4 ☌	♒ 2.3 ☌		☋♆ 3.1 ♁
6	10.8 ☌	♉								
7		♊	♒ 8.9 ♁				□ 4.0 ☌	□ 9.0 ☌		
8		♊				♒ 10.9 ♁				
9	.5 ♁	♋	□ 2.4 ☌	△ 1.3 ☌	♒ 1.7 ☌		△ 6.2 ☌			
10		♋				□ 4.8 ☌		△ 7.2 ♁		
11	4.7 ♁	♌	△ 10.2 ☌	□ 5.0 ☌	□ 6.4 ☌					
12		♌								
13	8.8 ♁	♌		♒ 9.5 ☌		△ .1 ♁				
14		♍			△ .8 ♁		− 4.5 ♁			
15	3.2 ☌	♍						− 9.5 ♁	− 8.6 ☌	
16		♎	− 8.3 ☌							
17		♎				− 9.0 ☌				♅♅ 6.4 ♁
18	1.1 ♁	♏		☿ 2.1 ☌	− 7.6 ☌					♅♇ 6.4 ♁
19		♏					△ .2 ♁			
20	12.5 ♁	♏								
21		♐					□ .5 ☌	△ 2.6 ♁		
22		♐	△ 6.3 ♁							
23	1.5 ♁	♑		♒ 1.3 ☌	△ 9.5 ☌	△ 3.9 ♁				
24		♑	□ 8.4 ☌				♒ 3.8 ♁	□ 1.3 ♁		
25	10.5 ♁	♑		□ 9.6 ☌		□ 3.1 ☌				
26		♒			□ 8.2 ♁			♒ 6.6 ☌		
27	6.1 ☌	♒	♒ 11.1 ♁							
28		♓		△ 7.3 ♁	♒ 4.7 ☌	♒ 4.5 ♁				
29		♓					☿ 1.7 ♁			
30	5.2 ♁	♈							☿ 8.6 ♁	

MONTH 2

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♈								
2	6.8 ☌	♈	☿ 5.4 ☌	− 3.7 ☍		☿ 8.8 ☍		☿ 2.6 ☌		☋☿ 11.7 ☌
3		♉			☿ 5.6 ☌		♒ 2.3 ☍			
4	9.7 ☌	♉								
5		♊					□ 6.1 ☍			
6	10.1 ☌	♊	♒ 2.0 ☍	△ 5.6 ☍				♒ 7.2 ☍		
7		♋			♒ 9.2 ☌	♒ 6.4 ☌	△ 9.2 ☍			
8	10.9 ☌	♋	□ 7.6 ☍	□ 6.5 ☍						
9		♌			□ 12.6 ☌	□ 11.8 ☌		□ 5.6 ☌		
10	3.1 ☍	♌								
11		♍	△ 8.8 ☌	♒ 2.4 ☌	△ 5.9 ☍	△ 7.8 ☍		△ 7.4 ☍		
12	8.9 ☍	♍					− 2.0 ☍			
13		♎							− 1.5 ☌	
14		♎								☊☊ 13.0 ☌
15	8.5 ☌	♎		☿ 4.3 ☍						☊☊ .0 ☍
16		♏	− 11.7 ☌		− 2.7 ☍	− 9.7 ☍				
17	6.2 ☍	♏					△ 7.6 ☍	− 13.2 ☌		
18		♐								
19		♐								
20	8.6 ☌	♐		♒ 3.8 ☍			□ .6 ☍			
21		♑	△ 7.2 ☍		△ 6.3 ☍					
22	7.7 ☍	♑				△ 8.8 ☌				
23		♒		□ 6.7 ☌			♒ 9.1 ☌	△ 12.5 ☌		
24		♒	□ 1.1 ☍		□ 10.8 ☌					
25	9.1 ☌	♒		△ 2.3 ☍		□ .4 ☌				
26		♓			♒ 4.8 ☍			□ 6.7 ☌		
27	1.2 ☍	♓	♒ 2.9 ☌			♒ 10.4 ☌			☿ 2.4 ☍	
28		♈					☿ 9.3 ☌	♒ 3.2 ☍		
29	3.2 ☍	♈								☋☿ 8.8 ☍
30		♉		− 1.1 ☌						☋☿ 2.3 ☌

MONTH 3

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1	3.7 ☌	♉	☿ 1.4 ☌		☿ 2.0 ☍	☿ 4.0 ☌				
2		♊					☓ 2.8 ☌			
3	4.3 ☌	♊						☿ 6.6 ☍		
4		♋		△ .6 ☍			□ 6.7 ☌			
5	5.0 ☌	♋			☓ 4.5 ☍					
6		♌	☓ .1 ☍	□ 1.1 ☍		☓ .8 ☍				
7	7.4 ☌	♌			□ 6.8 ☍		△ 1.9 ☍	☓ 4.5 ☌		
8		♍	□ 6.7 ☍	☓ 3.7 ☍		□ 6.3 ☍				
9		♍			△ 12.8 ☍					
10	4.0 ☍	♎	△ 2.9 ☌			△ 1.2 ☌		□ 6.0 ☍	− 4.1 ☍	
11		♎					− 8.6 ☌			♋♋ 2.6 ☌
12	13.2 ☍	♎		☿ 4.2 ☌				△ 5.1 ☌		♉♈ 3.6 ☌
13		♏								
14		♏			− 10.6 ☍					
15	2.1 ☍	♐				− 8.0 ☌				
16		♐	− 3.8 ☍							
17	.2 ☌	♐		☓ 5.4 ☌			△ 13.6 ☍			
18		♑						− 3.7 ☍		
19		♑			△ .6 ☌					
20	3.9 ☍	♒		□ 8.8 ☍			□ 8.7 ☍			
21		♒	△ .1 ☌			△ 7.4 ☍				
22	15.0 ☍	♒		△ 4.4 ☌	□ 4.5 ☍					
23		♓				□ 4.9 ☌	☓ 1.1 ☍	△ 2.6 ☍		
24	7.5 ☌	♓	□ 4.6 ☍		☓ 13.6 ☍				☿ 6.1 ☌	
25		♈						□ 7.7 ☍		
26		♈	☓ 14.2 ☍			☓ 5.0 ☍				
27	3.2 ☍	♉		− 6.6 ☍			☿ 5.6 ☌	☓ 9.1 ☍		♍♆ 7.5 ☍
28		♉			☿ 7.0 ☌					
29	4.6 ☍	♊								
30		♊	☿ 8.1 ☌			☿ 12.4 ☍				

MONTH 4

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1	4.6 ☌	♋		△ 7.8 ☌				☿ 4.9 ☌		
2		♋					☍ 7.0 ☌			
3	6.7 ☌	♌		□ 9.6 ☌	☍ 1.8 ☌					
4		♌				☍ 5.3 ☍	□ 12.2 ☌			
5	8.1 ☌	♌	☍ 9.5 ☌	☍ 11.1 ☌	□ 3.9 ☌			☍ 2.0 ☌		
6		♍					△ 4.0 ☍			
7	13.2 ☌	♍	□ 5.3 ☍		△ 8.3 ☌	□ 2.0 ☌		□ 2.4 ☌	− 9.8 ☌	
8		♎								
9	4.6 ☍	♎		☿ 7.8 ☍		△ 11.9 ☌		△ 6.2 ☌		☪☪ .5 ☌
10		♏	△ 6.1 ☌							☉☍ 1.5 ☌
11		♏					− 8.2 ☍			
12	7.0 ☌	♐			− 4.9 ☌					
13		♐								
14	5.2 ☍	♐		☍ 8.5 ☍		− 4.3 ☍		− 4.4 ☌		
15		♑	− 2.7 ☍							
16		♑								
17	8.1 ☌	♑		□ 11.3 ☌	△ 8.1 ☌		△ 13.6 ☌			
18		♒								
19	5.6 ☍	♒		△ 8.6 ☍	□ 6.7 ☍			△ 9.7 ☌		
20		♓				△ 2.6 ☌	□ 8.0 ☌			
21		♓	△ 4.0 ☌							
22	6.7 ☌	♈			☍ 8.5 ☌	□ .4 ☍	☍ 7.8 ☍	□ .1 ☌	☿ 2.5 ☌	
23		♈	□ .9 ☍							
24	13.1 ☌	♈		− 1.0 ☍				☍ 11.4 ☌		☋☿ 3.6 ☍
25		♉	☍ 9.1 ☍			☍ 1.2 ☌				
26	.4 ☍	♉			☿ 3.5 ☍					
27		♊					☿ 13.9 ☌			
28	.9 ☍	♊		△ 3.3 ☍				☿ 7.6 ☍		
29		♋				☿ 6.1 ☌				
30	1.1 ☍	♋	☿ 7.0 ☌	□ 3.5 ☍	☍ 5.3 ☍					

MONTH 5

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♌					☌ 8.4 ☍			
2	3.1 ☍	♌		☌ 5.7 ☍	□ 8.2 ☍					
3		♍				☌ 13.9 ◐		☌ 13.2 ◐		
4	7.2 ☍	♍	☌ 5.2 ☍				□ 7.6 ◐		− 2.1 ☍	
5		♎			△ 3.8 ◐	□ 7.0 ☍				
6		♎					△ 4.6 ☍	□ 1.0 ◐		♋♋ 9.3 ◐
7	4.4 ◐	♏	□ 6.7 ◐	☿ 7.4 ◐						♈♉ 9.3 ◐
8		♏				△ 7.6 ◐		△ 2.0 ☍		
9	12.0 ◐	♏	△ 4.5 ☍		− 5.7 ☍					
10		♐								
11		♐								
12	2.0 ◐	♑		☌ 5.4 ◐			− 4.6 ◐			
13		♑				− 1.0 ☍				
14	.6 ☍	♑		□ 4.4 ☍				− 14.3 ◐		
15		♒	− 9.5 ◐		△ 1.4 ◐					
16		♒								
17	1.7 ◐	♓		△ 5.5 ◐	□ 12.2 ◐		△ 2.1 ☍			
18		♓				△ 5.8 ☍				
19	11.5 ◐	♓			☌ 8.3 ☍				☿ 4.6 ◐	
20		♈	△ 13.9 ◐				□ 7.3 ◐	△ 6.2 ◐		
21	5.3 ☍	♈		− 9.1 ☍		□ 7.6 ◐				
22		♉					☌ 5.0 ☍	□ 7.4 ☍		♍♎ 1.0 ◐
23	8.7 ☍	♉	□ .3 ◐			☌ .6 ☍				
24		♊			☿ 9.0 ◐					
25		♊	☌ 5.4 ◐					☌ 6.5 ◐		
26	.2 ◐	♋		△ 3.8 ◐						
27	9.6 ☍	♋				☿ 5.7 ☍	☿ 6.1 ◐			
28		♌		□ 3.1 ◐	☌ 10.4 ◐					
29		♌	☿ 13.4 ◐					☿ 7.8 ☍		
30	1.8 ◐	♍		☌ 6.2 ◐	□ .8 ☍					

MONTH 6

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♍					☌ 6.6 ☍		− 9.1 ☍	
2	6.2 ☌	♎			△ 6.3 ☍	☌ 6.8 ☌				
3		♎								♑♑ 4.2 ☍
4	13.4 ☌	♎	☌ 8.2 ☌	☿ 5.2 ☍		□ 3.2 ☍	□ 8.4 ☌			♑♐ 5.2 ☍
5		♏						☌ 2.3 ☌		
6	8.8 ☍	♏	□ 8.2 ☍				△ 9.8 ☍			
7		♐			− 13.3 ☌	△ 4.5 ☌		□ 6.7 ☍		
8		♐								
9	7.1 ☌	♐	△ 11.5 ☌	☌ .0 ☍						
10		♑						△ 3.2 ☍		
11	6.4 ☍	♑								
12		♒		□ 2.3 ☌	△ 12.8 ☌	− 9.2 ☌	− 10.1 ☌			
13		♒								
14	8.7 ☌	♒	− 10.1 ☍	△ 2.4 ☍						
15		♓			□ 1.5 ☌					
16	4.2 ☍	♓						− 9.8 ☌	☿ 7.6 ☌	
17		♈			☌ 9.8 ☌	△ 11.9 ☌	△ 5.8 ☍			
18		♈								
19	.6 ☌	♉	△ 8.8 ☍	− 7.3 ☌		□ 7.6 ☍				♍♑ 6.4 ☌
20		♉					□ 4.7 ☌			
21	4.0 ☌	♊			☿ 7.6 ☍			△ 11.0 ☌		
22		♊	□ 5.7 ☌			☌ 2.8 ☌	☌ 1.3 ☍			
23	8.2 ☌	♊		△ 2.8 ☍				□ 8.2 ☍		
24		♋	☌ 12.5 ☌							
25	9.7 ☌	♋		□ 4.3 ☍						
26		♌			☌ 1.1 ☌	☿ 10.8 ☌		☌ 3.1 ☌		
27	9.4 ☌	♌		☌ 5.0 ☍			☿ 1.1 ☌			
28		♍	☿ 10.1 ☍		□ 2.1 ☌					
29	1.8 ☍	♍							− 3.9 ☌	
30		♎			△ 7.6 ☌	☌ 10.9 ☍		☿ 7.3 ☍		

MONTH 7

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1	8.5 ☍	♎					☌ 10.1 ☍			☊☊ 3.2 ☌
2		♏		☿ 6.1 ☌						☊α 3.1 ☌
3		♏	☌ 10.2 ☍			□ 10.4 ☌				
4	5.9 ☌	♐					□ 1.8 ☍			
5		♐			− 1.0 ☌	△ 11.6 ☍		☌ 11.1 ☍		
6	3.6 ☍	♐	□ 1.2 ☍							
7		♑		☌ 2.1 ☌			△ 5.7 ☌			
8		♑						□ 11.3 ☌		
9	3.6 ☌	♒	△ 6.3 ☌	□ 3.1 ☍	△ 11.2 ☍					
10		♒								
11	2.7 ☍	♒				− 4.7 ☌		△ 4.4 ☌		
12		♓		△ 2.2 ☌	□ 9.6 ☌		− 6.0 ☍			
13		♓							☿ .7 ☍	
14	4.1 ☌	♈	− 3.5 ☍		☌ 8.8 ☍					
15		♈						− 10.8 ☍		
16	6.4 ☌	♈		− 6.6 ☍		△ 3.4 ☌				☋♆ 10.8 ☌
17		♉					△ 7.2 ☍			
18	10.7 ☌	♉				□ 10.1 ☌				
19		♊	△ 3.4 ☌		☿ 1.3 ☌		□ 11.5 ☍			
20	10.5 ☌	♊		△ 11.1 ☍		☌ 11.4 ☌		△ 1.3 ☌		
21		♋	□ 9.4 ☌							
22	3.0 ☍	♋					☌ 7.4 ☌	□ 3.0 ☌		
23		♌	☌ 5.9 ☍	□ 3.0 ☌	☌ 7.0 ☌					
24	6.0 ☍	♌				☿ 11.2 ☍		☌ 4.5 ☌		
25		♍		☌ 5.9 ☌	□ 9.4 ☌					
26	10.1 ☍	♍							− 8.4 ☌	
27		♎			△ 3.3 ☍		☿ .7 ☌			
28		♎	☿ 10.8 ☌					☿ 9.8 ☌		☊☊ 9.5 ☌
29	4.7 ☌	♏		☿ 8.1 ☍		☌ 4.5 ☍				☊α 9.5 ☌
30		♏								

MONTH 8

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1	3.1 ☍	♏								
2		♐			− 8.0 ♁	□ 4.7 ♁	☌ 6.8 ♁			
3		♐	☌ 6.2 ☍					☌ 2.1 ♁		
4	1.6 ♁	♑		☌ 8.0 ☍		△ 9.0 ☍				
5		♑					□ 1.7 ♁	□ 1.6 ☍		
6	1.5 ☍	♑	□ 9.1 ♁							
7		♒		□ 4.7 ♁	△ 4.8 ♁		△ 6.6 ☍	△ 10.6 ☍		
8	10.7 ☍	♒	△ 12.5 ☍							
9		♓		△ 4.3 ☍	□ 3.4 ☍	− 9.9 ☍				
10		♓							☋ 4.9 ☍	
11	6.5 ♁	♓			☌ 11.8 ☍					
12		♈						− 7.2 ☍		
13	4.7 ☍	♈					− 1.5 ♁			♆ 9.8 ☍
14		♉	− 1.5 ♁	− 7.6 ♁		△ 5.5 ☍				
15	6.5 ☍	♉								
16		♊			☋ 6.3 ♁	□ 9.7 ☍				
17	8.4 ☍	♊					△ 5.4 ☍	△ 3.4 ♁		
18		♋	△ 1.6 ☍	△ 1.0 ☍		☌ 12.7 ☍				
19	9.6 ☍	♋					□ 11.0 ☍	□ 8.1 ♁		
20		♌	□ 7.5 ☍	□ 3.4 ☍	☌ 8.4 ♁					
21	11.9 ☍	♌						☌ 4.9 ☍		
22		♍	☌ 13.9 ☍	☌ 6.1 ☍	□ .1 ☍		☌ 3.5 ♁			
23		♍				☋ 8.7 ♁			− 1.0 ☍	
24	2.1 ♁	♎			△ 6.4 ☍					
25		♎								♅ 6.1 ☍
26	.2 ☍	♎						☋ 2.8 ☍		♇ 5.1 ☍
27		♏		☋ 7.5 ♁			☋ 4.9 ♁			
28	11.0 ☍	♏	☋ 1.5 ♁			☌ 6.9 ♁				
29		♐			− .0 ☍					
30		♐				□ 10.0 ☍				

MONTH 9

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1	6.7 ♂	♐								
2		♑		♒ 6.8 ♂			♒ 7.5 ☍	♒ 1.5 ♂		
3	11.7 ☍	♑	♒ 2.1 ☍			△ 2.2 ☍				
4		♒		□ 12.7 ☍	△ .5 ☍					
5		♒					□ 4.7 ☍	□ 2.8 ♂		
6	7.9 ♂	♒	□ 5.1 ♂		□ 8.9 ☍					
7		♓		△ 7.0 ♂				△ 9.0 ☍	☿ 12.7 ☍	
8	6.2 ☍	♓	△ 8.1 ☍			☌ 3.1 ☍	△ 4.1 ♂			
9		♈			♒ 1.3 ♂					
10	12.4 ☍	♈								
11		♉		☌ 11.2 ☍						☋☿ 3.6 ♂
12		♉						☌ 8.9 ☍		
13	.7 ♂	♊	☌ 1.2 ☍		☿ 8.5 ♂	△ 2.2 ♂	☌ .8 ♂			
14		♊								
15	4.1 ♂	♋				□ 7.5 ♂				
16		♋		△ .3 ♂						
17	2.3 ♂	♌	△ 9.8 ☍		♒ 8.9 ♂	♒ 8.0 ♂	△ 2.2 ☍	△ 8.3 ♂		
18		♌		□ .6 ♂						
19	3.4 ♂	♍			□ 1.0 ☍		□ 9.0 ☍	□ 7.7 ☍		
20		♍	□ 1.2 ♂	♒ 3.7 ♂					☌ 5.1 ☍	
21	8.2 ♂	♍			△ 5.6 ☍	☿ 10.4 ☍				
22		♎	♒ 2.5 ☍				♒ 5.2 ♂	♒ 6.2 ♂		☊☊ 11.5 ☍
23	6.2 ☍	♎								☊τ 11.5 ☍
24		♏		☿ 9.9 ☍						
25		♏								
26	1.9 ♂	♐			☌ 7.9 ♂	♒ 11.2 ☍				
27		♐	☿ 10.6 ☍				☿ 6.1 ☍	☿ 14.2 ☍		
28	5.7 ☍	♐								
29		♑		♒ 11.5 ☍		□ 2.4 ☍				
30		♑								

MONTH 10

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1	2.5 ♂	♒			△ 7.3 ♂					
2		♒		□ .8 ☌		△ 2.5 ♂				
3	6.4 ☌	♒	☍ 7.8 ♂		□ 10.5 ☌		☍ 6.0 ♂	☍ 11.9 ☌		
4		♓		△ 12.7 ☌						
5		♓	□ 13.2 ☌				□ 12.9 ☌		☋ 4.2 ♂	
6	.3 ♂	♈			☍ 3.7 ♂			□ 5.4 ☌		
7		♈				− 2.9 ♂				
8	7.3 ♂	♈	△ .7 ☌				△ 1.6 ☌			♆ 3.5 ☌
9		♉		− 2.3 ☌				△ 4.0 ♂		
10	1.5 ☌	♉			☿ 3.9 ☌					
11		♊				△ 5.2 ☌				
12	2.5 ☌	♊	− 12.2 ☌				− 15.0 ☌			
13		♋		△ 6.0 ☌		□ 8.2 ☌		− 11.4 ☌		
14	4.3 ☌	♋			☍ 6.0 ☌					
15		♌		□ 7.6 ☌		☍ 11.3 ☌				
16	4.9 ☌	♌			□ 6.3 ☌					
17		♍	△ 6.5 ♂	☍ 8.6 ☌			△ 2.4 ☌		− 11.1 ☌	
18	6.7 ☌	♍			△ 8.0 ☌			△ 1.8 ☌		
19		♎	□ 4.9 ☌				□ 11.2 ☌			
20	12.2 ☌	♎				☿ 5.0 ♂		□ 14.0 ☌		♅ 3.5 ♂
21		♏								♇ 3.5 ♂
22		♏	☍ 2.0 ♂	☿ 6.0 ♂			☍ 1.3 ☌			
23	6.7 ♂	♏			− 7.6 ♂			☍ 7.3 ☌		
24		♐								
25	9.8 ☌	♐				☍ 6.4 ♂				
26		♑								
27		♑	☿ 5.9 ☌	☍ 8.6 ♂		□ 14.4 ☌				
28	9.0 ♂	♑			△ .2 ☌		☿ 2.9 ♂			
29		♒		□ 10.7 ☌				☿ 6.7 ♂		
30	11.1 ☌	♒			□ 11.3 ☌	△ 3.7 ☌				

MONTH 11

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♓								
2		♓		△ .9 ☌					☿ 9.2 ☍	
3	9.0 ☍	♓	☓ 2.4 ☍		☓ 9.0 ☍		☓ 7.0 ☌			
4		♈						☓ 6.0 ☌		
5	7.3 ☌	♈	□ 5.7 ☌			− 5.1 ☌				♑ 12.4 ☌
6		♉					□ 5.2 ☍	□ 14.2 ☌		
7	11.8 ☌	♉	△ 14.4 ☌	− 1.6 ☍	☿ 11.6 ☌					
8		♊					△ 4.5 ☌			
9	13.4 ☌	♊						△ 2.8 ☍		
10		♋				△ .2 ☍				
11	12.4 ☌	♋		△ 3.7 ☍	☓ 12.2 ☌					
12		♌	− 7.5 ☍			□ .7 ☍	− 13.7 ☌			
13	13.8 ☌	♌		□ 4.9 ☍	□ 13.7 ☌			− 3.3 ☍		
14		♍				☓ 3.8 ☍				
15		♍		☓ 7.4 ☍					− 3.9 ☍	
16	1.4 ☍	♎	△ 9.9 ☌		△ 1.5 ☍					
17		♎					△ 5.0 ☌	△ 6.0 ☍		♓ 2.1 ☌
18	6.3 ☍	♎				☿ 4.5 ☌				♈ 1.1 ☌
19		♏	□ 5.2 ☍	☿ 7.4 ☌				□ 6.8 ☍		
20	3.1 ☌	♏			− 3.2 ☌		□ 2.6 ☍			
21		♐	☓ 8.8 ☌					☓ .0 ☌		
22		♐					☓ 10.9 ☌			
23	1.7 ☍	♑				☓ 5.2 ☌				
24		♑		☓ 7.9 ☌						
25	4.8 ☌	♑			△ 5.3 ☌					
26		♒				□ 6.5 ☍		☿ .6 ☍		
27		♒	☿ .4 ☌	□ 7.8 ☍						
28	4.4 ☍	♓			□ 5.0 ☍	△ 10.6 ☌	☿ 3.8 ☌			
29		♓		△ 8.3 ☌					☿ 1.3 ☌	
30	4.5 ☌	♓			☓ 5.5 ☌			☓ 11.2 ☌		

MONTH 12

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♈								
2		♈	☌ 7.3 ☿							
3	.6 ☌	♉				− 9.1 ☿	☌ 11.1 ☿	□ 5.8 ☌		☋☿ 5.2 ☌
4		♉		− 1.7 ☿						
5	5.7 ☌	♉	□ 3.8 ☌		☿ 7.1 ☌			△ 10.4 ☌		
6		♊					□ 7.0 ☌			
7	8.6 ☌	♊	△ 10.5 ☌							
8		♋		△ 6.3 ☿		△ 4.3 ☌	△ 2.0 ☿			
9	8.9 ☌	♋			☌ .1 ☿			− 7.1 ☿		
10		♌		□ 6.5 ☿		□ 5.9 ☌				
11	9.1 ☌	♌	− 7.5 ☿		□ .5 ☿					
12		♍		☌ 8.6 ☿		☌ 7.9 ☌			− .5 ☿	
13	1.5 ☿	♍			△ 4.2 ☿		− .5 ☌			
14		♎						△ 5.4 ☌		♅♅ 11.5 ☿
15	6.0 ☿	♎								♈♇ 11.5 ☿
16		♏	△ .8 ☿			☿ 9.3 ☿		□ 5.2 ☿		
17		♏		☿ 6.3 ☌			△ 11.5 ☿			
18	.2 ☌	♐			− 4.0 ☌		□ 7.3 ☌			
19		♐	□ .2 ☌				− .8 ☌	☌ 6.8 ☌		
20	8.7 ☌	♐					□ 1.9 ☿			
21		♑	☌ 3.2 ☿			☌ 5.0 ☿				
22	9.0 ☿	♑		☌ .6 ☌						
23		♒			△ 1.7 ☌		☌ 8.2 ☌			
24		♒		□ 2.2 ☿		□ 6.7 ☌		☿ 11.2 ☿		
25	9.5 ☌	♒			□ 4.3 ☿					
26		♓				△ 9.7 ☿			☿ 4.8 ☿	
27	10.0 ☿	♓	☿ 4.2 ☌	△ 3.0 ☌						
28		♈			☌ 3.9 ☌		☿ 9.8 ☿			
29		♈								
30	6.4 ☌	♈						☌ 2.4 ☿		☋☿ .1 ☿

MONTH 13

	MOON		SUN	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	
1		♉		− 7.8 ☌		− 4.3 ☌				
2	1.1 ☌	♉	♓ 5.8 ☍		♉ 7.8 ☌					
3		♊					♓ 9.8 ☌	□ 4.0 ☍		
4	5.5 ☌	♊	□ 2.4 ☌							
5		♋						△ 4.3 ☌		
6	8.6 ☌	♋								

PREDICTIONS

THE PREDICTIONS ACCOMPANYING THE ALMANAC

Predictions for the year covered by the almanac are written in the pages preceding the tables, and in the margins to left and right of the tables themselves. The text has been edited in the CCAG and elsewhere, as noted in the introduction, but without translation. This may be a convenient place therefore to offer a version of this difficult material.

/155/ To begin with the aid of God, the year 6844, while the Sun passed from Pisces to Aries, the 12th of the present month of March, 3rd day[1] <Tuesday>, at the 4th hour of the day, Cancer being at the horoscope and Moon and Venus being 'lord of the house'[2].

Confident therefore in the unutterable patience of God and in his great mercy, we write in advance the events to come in the present year. It will therefore be good, and pleasing to God, for all Christians, and especially for our powerful and holy sovereign and King, with our very pious Lady, and the whole palace guarded by God, as well as for the army, and at the same time for the supreme archon of our powerful and holy Sovereign and King, the Grand Comnenus, and for the Protonotary and Protovestiary, Master Constantine Loukites: may the Lord keep them, he and them, and protect them, He the Creator of the years and who reigns for ever and ever, Amen.

/155^{v}/ Here is the interpretation of the whole year.

Shows, in sum, during this year, much harmony among men and women and displacements of peoples from one place to another, and upheaval from one state to another. Here and there also famine and penury; and poverty will appear among the people, and this will not be for the good, but here and there there will be wars and shedding of blood; attacks by savage beasts, and men will suffer injuries because of these. Spring will be cold and humid, summer moderate, autumn windy, and winter very humid. Inhabitants of Roman regions will be in peace and prosperity. For women suckling good health, and for people inflammation[3]. Heavy and beneficial rain, good winds. Goodwill among the people and exporting of goods. Joy for the powerful, and for grammarians. Easy confinements for women and good order in the universe. Rumours, true one regarding the kings, others regarding ordinary people, for the most part false. Good routes for travellers and surveillance by kings of the business of the people. Abundance of perfumes, of precious stones, and of pearls and of fish. But the truth, God alone knows, and no one else.

/156/ Here one must examine the business of kings.

<This> shows health for kings, confidence, victory, pleasure and joy within the palace and the increase of the glory. Certain kings will discover plots. Sometimes there will be successions, especially in Babylon, Tabriz and Palestine. Many rumours against them, and most <of the business> will be uncertain.

For the great here is what one gets.

For the great and the archonts, joy and gain, and the familiarity with the kings and the loss of their responsibility; for some there will be hatred and opposition, but they will conquer these.

For grammarians and notaries, this:

For the notaries and the grammarians: good humour, generosity and joy within the palace; they will have the power over certain regions and cities; their speeches will be true and will please the magnates.

What will come to prelates and clerics:

For prelates and for all those in the priestly lists, rectitude, piety, good hope, many discussions on faith, with victory over those who contradict them; some of these worthy of belief will die.

/156^{v}/ For the archonts and soldiers[4], this:

<This> shows the humbling and the submission to kings, and some of them will be resented and quite overcome by continual servitude.

For old men and eunuchs, this:

For famous and noble old men, reduction of outlay, and adversities and loss of faith itself, and they will give rise to lies and wicked rumours. For eunuchs, contradiction at the present time, and after some time, redress, generosity, familiarity and influences within the royal courts.

For women in the public eye, a particular humiliation, but their reputation will be redressed by the people and by certain letters, and they will be rehabilitated and in good health.

For businessmen and merchants.

For merchants, frequent voyages with gains, but following certain missions they will have doubts; and they will not be without missions during the whole of spring.

Many ambassadors to the king with fine and true missives, but the kings will not be fully confident in them.

For players (musicians or comedians), joy and profit; and they will produce new poems, so that the people will give them a hearing.

/157/ For the common people and the bazaar merchants:

speed of transactions and profit, especially for those who sell merchandise coming from the sea.

There will be numerous wars, and massacres here and there, especially in Āmida (Ἀμήτην), Mistri (Μήστριν), Kurdistan (Κουρτιστάν), Gīlān (Κοιλάνην) and Mūqān (Μουγάν)[5], mainly during the month of April.

There will be increase in purchases with a great demand for wheat, barley and other similar commodities with a rise in prices and a landing <of merchandise>, and there will be a greater scarcity among the Turks, the Arabs, and in the neighbourhood of Ḫazza (τοῦ Χάτζης)[6].

Frequent access of weakness and lassitude, but thanks to the invocation of the saints and recourse to remedies, these will be easily cured. As to the kinds of the illness, they will be these: angina, pneumonia, apoplexy, spasms, and headaches, and certain cardiac conditions; the most fatal of these will be conditions of bowel and of the womb.

/157^{v}/ In particular, on the state of the Spring, <this>:

At the beginning Spring will just a little rainy and <the temperature> average; the month of May will be dry and of average coldness. Many signs will appear in the air and <will be> alarming: darkening of the air and humidity, average buying, and with increase in prices. Most of the things written previously will be injurious to everyone[7] and in particular for the scholars (γνωστικῶν). Obstruction caused by men of average condition towards the greater.

<In particular on the condition of summer, this>

Summer will be even as regards heat, and somewhat dry. Power of kings and great persons. Here and there wars, business gatherings. Weaknesses and sufferings. Abundance of goods, and in the region of Khazaria locusts will appear. Average buying.

<In particular on the condition of autumn, this>

/158/ Autumn will be windy and the winds will be strong and uncontrolled. In certain places, earthquakes. Appearances of kings and forces of courageous and redoubtable men, plots and wickedness, counterfeiting of money, and seeking of silver and gold. Stomach aches. Damages caused by savage animals to the vines, darkening of the air, and a rise <in prices> of goods.

<In particular on the condition of winter, this>

The winter will be moderate with little snow. Much ice. Shortage of goods. Famine and distress here and there, especially in somewhat humid places. Power of the Romans against their enemies. Increase <in price> of goods.

/158^{v}/ On the first term (στοίχος) among the Tatars, the Rat[8].

This year the chronokrator of the Tatar kingdom is the Rat. And <this> shows that it will be at peace and fine. From the middle of the year until the 9th month the season will be humid and pleasant, and fruits will be abundant. Every time that the air becomes dry and obscured, it indicates sheddings of blood. Reflections among the sovereigns and kings. Violence in the Winter season. A number of rats, and they will cause much harm. Appearance of thieves and brigands who will be arrested by the kings. A child born this year will have large eyes, and will come to honours and greatness. Those conceived[9] at the beginning of the year will be mainly boys; those conceived[10] in the middle will be faint-hearted, those conceived at the end will be liars.

(The following paragraphs are written in the margins of the Almanac itself, corresponding to the successive decans of the calendar.)

/161/ (Mar 12-21)

Shows: mist and darkening in the air. Piety of people, discussions among scholars, abundance of water, eloquence for good speakers, useful rains.

(Mar 22-31)

Shows: joy for eunuchs; enmities and many contentions; goodness of priests;

affliction of soldiers; increase in merit of notaries, and signs of glory for kings.

(Apr 1-10)

Shows: massacres of men in the west, and mortality of quadripeds, death of birds. Scarcity of goods, and great mortality in Syria (Σιαμ[11]). Pain of the oesophagus. Wars in some places and against humidity.

/162/ (Apr 11-20)

Shows: movement of winds and rain. Illnesses of women. Suspensions of grazing; hard nature of kings; affliction of notaries and great men, and many quarrels and enmities; disturbances and coldness of the season.

(Apr 21-30)

Shows: strife of the magnates with the grammarians; honour of eunuchs; thunder-showers and much mist; enemies appear.

(May 1-10)

Shows: useful rain, and joy of the grammarians; rumours and many messages; coldness of the season, moderate temperature.

/163/ (May 11-20)

Shows: many troubles in northern regions; appearance of enemies, and weakness due to fermentation (boiling ?); violent winds; death of a certain man; rain.

(May 21-30)

Shows: people preoccupied in their own worship[12]; joy among prelates; bodily health of eunuchs; humidity of the season.

(May 31-Jun 9)

Shows: abundant rain and many rumours and comprehension of grammarians; absence of goods; zeal among some for magical operations.

/164/ (Jun 10-19)

Shows: harm for old men in poor health; unsteadiness in buying, much rain and violent winds and death of children and fear and weaknesses for young people such as surgeons ('vein-cutters') and butchers.

(Jun 20-9)

Shows: high prices in buying, troubles in the east, power of 'gnostics' (Gnostics, reasonable people ?); goodness and uprightness of men; much care and success and moderation of the season.

(Jun 30-Jul 9)
Shows: opposition and murmuring of the people with anger and keenness; great wind and rain; gladness and courage in the army.

/165/ (Jul 10-19)
Shows: courage of kings, of the magnates, and of monks, and abundance of seed;oppression of merchants; liberality of Saracens (Ἀγαρηνοί); anger of kings; much rain.

(Jul 20-29)
Shows: justice of kings; goodness of old men; wintry weather; discourses among scholars.

(Jul 30-Aug 8)
Shows: quantity of secret and hidden (*or* mystical) deeds and words; and certain kings will be impeded in their pronouncements; thunder and lightning and dust.

/166/ (Aug 9-18)
Shows: heat and dog-days of the season; disturbance of the air and clouds; combat of the magnates and war in the Turkish region and in Tartary; injuries of women; joy for grammarians.

(Aug 19-28)
Shows: particular (*or* partial) injury of women and lamentation of women in Turkish regions and beating of chests; injustice of kings; joy of gnostics (see Jun 20); mildness of season and very warm.

(Aug 29-Sep 7)
Shows: moderation of the season; goodness of grammarians; health of Christians; wind and rain.

/167/ (Sep 8-17)
Shows: much heat; hindrance for kings; goodness of old men; movement of the army; discretion of women.

(Sep 18-27)
Shows: violent wind; and justice of kings; hindrance and downfall of eunuchs; much rain: and great downfall at Mosul.

(Sep 28-Oct 7)
Shows: assumed unworthiness and justice of women; wind and rain; ruin of old men and of impecunious peasants and those from the hills; change of air.

/168/ (Oct 8-17)
Shows: discretion and goodness of women; appearance of enemies; violent wind; and humidity of the season; joy for gnostics.
(Oct 18-27)
Shows: plague and distress for Arabs and Turks; and the loss of old men as a result; and much rain.

(Oct 28-Nov 6)
Shows: hindrance for soldiers; many thieves; and many accusations; rain and humidity and injury to women.

/169/ (Nov 7-16)
Shows: rain and wind; appearance of kings; comprehension of grammarians; humidity of the season; affliction of women and eunuchs.

(Nov 17-26)
Shows: enemy incursions here and there; hostilities between kings and prelates; debauchery of women; and well-being and movement of the army.

(Nov 27-Dec 6)
Shows: useful and rain; and eloquence of players; injury for the powerful.

/159/ (Dec 7-16)
Shows: gladness and many goods and rain and injury to women; abundance of merchandise.

(Dec 17-26)
Shows: disturbance of air; benefits for monks; hindrance for grammarians; attack by brigands; appearance of chariots; discussions among scholars.

(Dec 27-Jan 5)
Shows: zeal of kings for the peoples affairs; men and women fighting; injury for the recent magnates; many goods.

/170/ (Jan 6-15)
Shows: winds and rain and dust; and double-dealing and disobedience of armies; justice from kings; in the West a great death and here and there an earthquake.

(Jan 16-25)
Shows: rain and snow and violent wind; much wintry weather will dominate and the season <will be> debilitating.

(Jan 26-Feb 4)
Shows: rain and discretion of women; power and resentment at kings; possible freezing.

/171/ (Feb 5-14)
Shows: debauch of women; force of winter season; quantity of waters; glory of the eunuchs; joy of the grammarians; justice from the kings; goodness of old men.

(Feb 15-24)
Shows: ice and attacks by brigands and appearance of chariots; weakness of children; violent wind; harmony between men and women.

(Feb 25-Mar 6)
Shows: glories of kings and coming out among the people and claims; rain and wind, and power of scholars and good.....

/172/ (Mar 7-12)
Shows: goodness and glory to the gnostics (See Jun 20); and rain.

COMMENT
The edition given by Boll is not really satisfactory, as we have seen from a detailed inspection of the manuscript. The verification of his edition is however frustrated by repairs which have been carried out since his time, because some text has been covered by the paper used in repairing the frayed edges of the leaves.

It may be observed that the medical predictions are detailed and use many technical terms which suggest that the author was a physician; cf. fol.157. The author seems to favour grammarians also, for whom joy is predicted through most of the year !

The many uses made of the predictions by historians of Trebizond have been noted in the Introduction.

NOTES TO THE PREDICTIONS

1. Note: the text of the CCAG omits '3rd day': the MS has μαρτίου μηνὸς ὁ (ie ἡμέρα) γ'.
2. We translate as if οἰκοδεσποτούντων; MS has οἰκοδεσποτοῦντος.
3. See CCAG, p.154, app.5. The text has πυρωνία, 'purchase of wheat', but the editor of the CCAG suggest πηρώματα 'mutilations' or πυρώματα 'inflammations'.
4. ἄρχοντες καὶ στρατιῶται; on these titles see Bryer (1986b) 71.
5. Āmida (Diyarbekir), Kurdistan, Gīlān, Muqān are all located in the region between Trebizond and the Caspian; see for example Le Strange (1905). Μήστριν is less clear. The suggestion by Lambros (1916), p.49, of a textual corruption of an intended Μήσιριν, derived from Miṣr (Egypt) is attractive, and indeed τὸ Μισίρι is found in another text, MS Athens, Bibl.Soc.Hist. 210 (CCAG 10 206-210). However Μήστρην is also found elsewhere, again in the accusative and repeated a number of times, so removing doubts about textual corruption in the present text; this is found in the MS St.Petersburg Public Library 575 (CCAG 12, 137-145). In this text the place is associated in some passages with Hindustan and Transoxiana (Παραθαλασσίαν). A great many places are named, but not in such a way as to imply the meaning of Μήστρην. Ancient forms with -στ-, such as Μέστρα, are found, clearly representing Miṣr, but all variants cited by Pauly-Wissowa use ε not η; Pauly-Wissowa, s.v. Mestraïm. Stephanus however records the form Μύσρα: ἐκλήθη καὶ Μύσρα ἡ χώρα ὑπὸ Φοινίκων; Meineke (1849), p.44. We may conclude that Μήστρη is yet another form of this word.
6. The reading is clearly -ης, not -η as in the edition, with an unclear gender. Neither Boll (1908) p.156, nor Lambros (1916) p.49, could made any suggestions about Χάτζη. Here it is proposed, with some reservation, that it be identified with the town referred to in Arabic as Ḥazza, 11 km SW of Arbīl, in southern Kurdistan; Ḥazza was at one time the capital of Adiabene. Mentioned by Strabo (XVI,I.1) as Χαζηνὴ, it occurs frequently in the Syriac literature as Ḥazzā, Ḥezzā. The various forms are given by Payne-Smith (1879), col 1238; see also the supplement, Margoliouth (1927), p.123, where further references will be found, including especially Nöldeke (1879), p.20. Of course other possibilites occur to one, including Γάζα in Palestine, which is sometimes written as Χάζα.
7. I translate πάντων as in the MS (CCAG: πάντως).
8. The Greek ποντικός, *mus Ponticus*, used to tranşlate Rat, the first term in the 12-year Sino-Turkish animal cycle. The year 1336-7 is in the third Stem (ping) in the 10-year cycle, and the first (tzŭ, the Rat) in the 12-year

animal cycle.

9. I translate following the edition: γεννώμενα 'conceived', but one hesitates, for the MS has γεννόμεν(α) (sic) 'born'.

10. γεννώμενα CCAG: the MS has γενόμενα.

11. From the Arabic Shām. The same form, τοῦ Σιαμίου, occurs in the MS Escorial IV.Ω.22; CCAG 11 Pars II, p.121.

12. Reading ἀνθρώπων πρό<σ>κυψις εἰς τὰς <ἰ>δίας θρησκείας; Lampe (1968) records this sense of πρόσκυπτω.

THE ALMANAC FOR 1353

THE ALMANAC IN THE PERSIAN SYNTAXIS

As we know the tables in the Syntaxis composed by George Chysococces *ca* 1346 are a transcription of those in the Zīj-i Īlkhānī of Naṣīr al-Dīn al-Ṭūsī[1]. It is therefore interesting to study remarks made in that work concerning planetary calculations, and in particular to examine Chrysococces' account of the composition of an Almanac. As noted above, he attributes such a composition to his teacher Manuel, in a remark which we regard as strong support for the view that the Almanac which he compiled is indeed the one for 1336/7 edited here. Chrysococces describes the composition in some detail. Moreover in some manuscripts of the Syntaxis such an almanac is found. In Vat gr.210 there is one month of such an almanac for March/April 1353, and this will be edited, and discussed in detail.

Before entering into an account of these parts of the Syntaxis, we should note that an almanac such we have in the present text was not a novel construction, for an ancient text which has been known for some time[2] describes the composition of an almanac very similar in some ways to the present one. Just as the Islamic zīj is based directly on the Handy Tables of Ptolemy, so we must accept that the almanac also was based on ancient Greek models.

According to this ancient account lines are ruled to divide the pages into columns and rows, with titles of columns above, and the positions of new and full moons below. The 15 horizontal divisions include 31 lines, as needed for the Roman calendar. In the columns we have the significance (ἐπισημασία) of the fixed stars, then the date in the month, Alexandrian and Roman and with room for those of another calendar, and the lunar month. The remaining columns are the following,

Motion of Moon in four columns: sign; degree, minutes; hour of transition; latitude, whether North or South;
Seven columns for Sun, 5 planets, name of month;
A wide column for general predictions.

In the six columns of the sun and the planets were recorded the configurations of the Moon with respective to the Sun or planet, trigonal, hexagonal, etc.

This description shows that what we have here is a prototype of the right hand page of our present almanac, the purely astrological part.

There are some brief remarks on the calculations to be made, for example, that

the Sun is calculated with full precision at ten day intervals, and then interpolated to get the positions for individual days. There is no indication however that these longitudes were recorded in the almanac itself.

CHRYSOCOCCES ON THE PREPARATION OF AN ALMANAC

In chapter 31 of the Syntaxis Chrysococces himself describes the composition of an almanac. The first page is to be arranged in 14 vertical and 17 horizontal divisions. Of the latter, the upper two are for a general title, and for the individual column names and zodiacal signs. The vertical divisions are

Days of the week
Days of the month: Arabic, Persian, Greek
Seven columns for the longitudes of Sun, Moon, planets
Lunar node
Length of day in hours
Daily motion of the Moon

The second page, facing the first, has 17 horizontal divisions, in line with those of the first page. The vertical divisions are

Sign of the Moon
Time of the Moon's transition from sign to sign
Configuration of Moon with the Sun
Six columns for the configuration of the Moon with planets
Latitudes of planets
Configuration of planets among themselves (transitions to signs, appearances and disappearances, exaltations, combustions.
Final column, divided horizontally into ten rows, 'decans', for predictions.

Chrysococces would have everything calculated with full accuracy on the first day, subsequently, the Moon every day, the Sun, Mars, Venus and Saturn every 5 days; Saturn, Jupiter and the Node every 10 days; For the remaining days interpolation is used.

In an example, he explains that the almanac should begin with the entry of the Sun into Aries, which 'at present' is March 13. He gives the Sun for days 1 and 5 as 0;38, and 4;35, and this is exactly correct for Mar 13, Mar 17 in the year 1346 which he uses for other examples, and for the meridian of Constantinople.

THE ALMANAC FOR 1353 IN VAT gr 210

In some copies of the Persian Syntaxis there is a portion of an almanac such as that described by Chrysococces. In the manuscript Vat gr 210, fol.26^{v} there is an interesting example of one drawn up for the period of one month, 1353 Mar 12 to Apr 10. Since it is somewhat later than the date used in the various examples which he presents, one should not assume that it is the work of Chrysococces himself, but rather a later addition. The almanac is edited here and as with the almanac for 1336, a transcription, and a calculation from the source, are also given.

Naturally one expects that the source is the Persian Syntaxis itself, ie the Zīj-i Īlkhānī. There is however a problem with the Moon, as there was in the Almanac for 1336. The agreement of the positions of the Sun, the lunar node and the planets as calcluated from the Persian Syntaxis is very close to those tabulated in the almanac. In the case of the Moon, however, agreement is substantially better with calculations made from the Zīj al-Alā'ī. The calculations are made for the meridian of Constantinople, taken as at 56° on the scale in which the meridian of the Syntaxis is 72°, as in Chrysococces' examples.

The problem of the source of the lunar calculations is however complicated by the fact that at the head of this almanac there is given the precise time, day 9;51, that is 3;51 p.m., for the full Moon on Wed March 20, together with its true position 187;57, and these details correspond well with the Zīj-i Īlkhānī, and definitely not with the Zīj al-Alā'ī. This is also the case with the new Moon whose details are given at the foot of the table: Thurs April 4, 2;8 after sunset on that day at the longitude 22;50. According to the almanac the length of that day is 13;1 hours, so that the time is 2;8 + (13;1)/2 = 8;38 after Noon. This adjustment for the exact length of the day does not seem to have been made for the time of the full Moon.

	Full Moon Mar 20		New Moon Apr 4	
	SUN	MOON	SUN	MOON
Zīj-i Īlkhānī	7;59.1	187;59.9	22;49.2	22;50.6
Zīj al-Alā'ī	8;40.8	188;22.6	23;31.4	23;23.0

Chrysoccocces' own calculation of the Moon's true position is illustrated in acalculation for Noon of A.Y.715 Μέερ (Mihr) 1, that is J.D.2212853, A.D.1346 June 18. The position which we call 'true' is for Chrysococces ἀνώμαλος ἐποχή,

'non-standard position', while he reserves the name ὁμαλὴ ἐποχή, 'standard position', for the position obtained in a final step by applying the correction of the equation of time. Here he has erred, because he has calculated the equation of time of the Moon by taking the value corresponding to the position of the Moon, instead of the Sun. The ἀνώμαλος ἐποχή of the Moon is 71;9,9 according to him (more exactly 71;9,54), while the ἀνώμαλος ἐποχή of the Sun is 94;3,47, and he has subtracted 0;10,43, the value equation of time of the Moon for the position 71. The correct value is 0;8,14, for the position 94[3]. In his calculation of the ὁμαλὴ ἐποχή for the Sun on the same date he has followed the correct procedure.

The equation of time would certainly not appear to have been included in either the calculation of the new Moon, or in the rest of the almanac, either according to the correct method, or according to Chrysococces' example.

In any case, in view of this difficulty in the handling of the equation of time, some further details will be given here concerning it.

THE EQUATION OF TIME IN THE SYNTAXIS

The equation of time for the Moon as tabulated in the Persian Syntaxis has been obtained simply by multiplying the equation of time for the Sun by the ratio of the daily motions of the Moon and Sun, 13.368. The title of the table makes clear the rule by which it is applied. In Vat gr 210, fol.62[r], for example,

κανόνιον τῆς ὀρθώσεως τῆς ☾, μετὰ τοῦ αὐθημερινοῦ τοῦ β[a] ζητεῖται, καὶ τὸ ἐξελθόν ἐκ τοῦ αὐθημερινοῦ αὐτοῦ ἀφαιρεῖται, καὶ τέλειον γίνεται·

Note a: του β written above a cancellation of word now unreadable, but which may have been αὐτῆς.

Table of the equation <of days> of the Moon, sought with the true position of the Sun, and the result is subtracted from its true position, and this is the final position.

The correction of αὐτῆς to τοῦ β may suggest that the earlier title erroneously instructed that the equation of time here should be calculated for the Moon's position.

Compare the more correct heading to this table in the Escorial manuscript Σ-I-11, fol.70[r],

κανόνιον τῆς ὀρθώσεως τῆς ἡμέρας, ἡ τῆς νυκτὸς τοῦ αὐθημερινοῦ τῆς ϛ′, μετὰ τοῦ αὐθημερινοῦ τοῦ ϐ ζητεῖται, καὶ τὸ ἐξελθόν, ἐκ τοῦ αὐθημερινοῦ τῆς ϛ′, ἀφαιρεῖται· καὶ τέλειον γίνεται:
Table of the equation of the days, or of the night of the true position of the Moon, sought with the true position of the Sun, and the result is subtracted from the true position of the Moon, and this is the final step.

In the instructions given in the preceeding text the procedure is not absolutely clear on this point. In Ch.17 (Vat gr. 210, 14^{r}, 14^{v}), we have

Περὶ τῆς ὀρθώσεως τῶν ἐποχῶν ϐ καὶ ϛ·

Ἰστέον ὅτι κανόνια ἐτέθησαν δύο. τὸ μὲν εἰς τὸ τέλος τῶν κανονίων τοῦ ϐ διὰ τὴν αὐτοῦ ὄρθωσιν ἤτοι τὴν ὁμαλὴν ἐποχήν. τὸ δὲ εἰς τὸ τέλος τῶν κανονίων τῆς ϛ. διὰ τὴν ταύτης ὄρθωσιν ἤτοι τὴν ὁμαλὴν ἐποχήν. ἐν ἡμέρᾳ οὖν συνόδου ἢ πϛ ἢ μετάβασεως ϐ ἢ ϛ ἀπὸ ζῳδίου εἰς ζῴδιον μετὰ τῆς εὑρισκο<μένης> /14^{v}/ ἀνωμάλου ἐποχῆς τοῦ ἡλίου, εἰσερχόμεθα εἰς τὸ ἴδιον ἑκάστῳ κανόνιον· καὶ τὰ ἐξερχόμενα λεπτὰ πρῶτα καὶ δευτέρα, τὰ μὲν τοῦ ϐ ἀφαιροῦμεν ἐκ τῆς ἐποχῆς τοῦ ϐ, ὥσπερ ἐρρέθη καὶ εἰς τὴν αὐτοῦ μεθοδικὴν ὑπόμνησιν. τὰ δὲ τῆς ϛ ἀφαιροῦμεν ἐκ τῆς ἀνωμάλου ἐποχῆς ταύτης· καὶ τὸ ἐναπολειφθὲν λέγεται ὁμαλὴ ἐποχὴ ϐ καὶ ϛ. αἱ γὰρ μὲν οὕτως ὀρθεῖσαι ἐποχαὶ ἀνωμάλοι λέγονται.

> Know that there are two tables, one at the end of the tables of the Sun, for its equation, ie the standard position, another at the end of the tables of the Moon, for its equation, ie the standard position. Finding therefore the non-normal position of the Sun on the day of conjunction or full moon or transition of the the sun or moon from one sign to another, entering into the appropriate table: in the case of the Sun we subtract the resulting minutes and seconds from the position of the Sun, as treated in the method mentioned. We subtract those of the Moon from its non-standard position, and the result is called the standard position of the Sun and Moon, while the positions corrected are called non-standard.

In the Persian Zīj-i Īlkhānī the same tables are found but, as we know, the Greek text of the Syntaxis is not a translation of the Persian rules preceeding the tables. The rule given in the title of the Persian table is as clear as in the Greek, while the procedure in the Persian text is more explicit:

> ...to the second equation we add the corrected equation; it is the taqwīm of the Moon; then we get from the table of the equation of days of the Moon for the taqwīm of the Sun at the time desired; this being done, we subtract from the taqwīm of the Moon for the corrected taqwīm;
>
> Cambridge UL Browne MS O.II(7) f.21^{r}.

The term taqwīm has been rendered as ἀνώμαλος ἐποχή, while in the Persian there is no special name for the result of the final correction.

The equation of time as tabulated is very well approximated by the expression[4]

$$\eta = \eta_o + (180/\pi)[\tan^2(\varepsilon/2) \sin 2\lambda + \sin E \sin(\lambda-\Gamma)] \quad \text{degrees}$$

where $\varepsilon = 23;35$, $\Gamma = 90;0$, $E = 2;0,30$, $\eta_o = 4;0$.

This is an interval of time measured by a sidereal rotation; during this interval the Sun moves by the amount

$$\eta \times \textit{daily motion of Sun} \times 60/360 \text{ arc-minutes.}$$

In the same interval the motion of the Moon in arc-minutes is equal to this quantity times 13.368. These motions of the Sun and Moon are the quantities tabulated as the 'equation of days' in the zīj, as functions of λ, the Mean Sun; whether applied to the Sun or Moon the argument λ is the position of the Sun. There are no corrections for the equation of time for the planets, since these would be insignificantly small. The tabulated values of the equation of time for the Sun and the Moon, together with the calculations from the above formula, are shown in Fig.22. In that Figure the curve for the Sun is least smooth, since although the values are smaller than those for the Moon, they are both rounded to the nearest minute.

The displacement η_o was adjusted of course so that the equation is positive, but it functions as a negative quantity, because it is subtracted from the position of the Sun or Moon. Other conventions are possible, and were used; with this displacement True Noon always proceeds Mean Noon.

NOTES

1. Mercier (1984).
2. Delambre (1817), 635-637; Halma (1825), 38. The text has been re-edited in an unpublished memoir by Botte (1968).
3. The table of the equation of time for the Moon in Vat.gr.210 is on fol.62^{r}.
4. The relation between this medieval expression and that used in modern astronomy is discussed by Mercier (1985).

Vat Gr 210, fol.26^{v}

πρῶτον καταβατὸν

πζ ὁ δ̄ μάρτιος κ̄ ὥρα θ̄ νᾱ τῆς ἡμέρας·
τέλειος τόπος πζ ἐν ♎ ζ̄ νζ̄· ὡροσκόπος ♏ θ̄ καὶ μεσουράνημα ♊ ε̄

ἔκθεσις κανόνων, τῶν περὶ τῆς τάξεως καὶ καταγραφῆς τῶν ἐφημερίδων														
	a	b	c	♂ ♐	☾ ♊	♃ ♑	♄ ♎	♆ ♐	☿ ♐	♀ ♐	☉ ♑	d	e	
	γ	ιβ	κε	κθ νη	κβ νβ	κ λγ	ιθ ιη	κδ λζ	κβ ν	ιθ κς	δ νβ	ιβ ϛ	κα νγ	1
	δ	ιγ	κς	ϛ νζ	ς λη	μ	θ	κε ιθ	κδ γ	κ κ	μθ	ιβ β	ιβ λθ	
	ε	ιδ	κζ	α νς	κ ς	μς	ιθ α	κς α	κε ις	κα ιδ	μς	ιβ δ	ιβ κθ	
	ς	ιε	κη	β νε	γ λγ	κ νγ	ιη νγ	μγ	κς κθ	κβ η	μγ	ιβ ς	ιβ κη	
	ζ	ις	κθ	γ νδ	ις νγ	κα ϛ	με	κζ κβ	κζ μβ	κγ β	μ	ιβ η	ιβ κα	
	α	ιζ	λ	δ νγ	κθ λδ	ζ	λζ	κη γ	κη νε	κγ νζ	λζ	ιβ ι	ια μβ	
τῦρ	β	ιη	α	ε νβ	ιβ γ	ιδ	κθ	2 μδ	ϛ γ		λγ	ιβ ιγ	ια κη	
	γ	ιθ	β	ς να	κδ ε	κα	κ	κθ κε	α ια		λ	ιβ ιε	ια γ	
π ☾	δ	κ	γ	ζ μθ	ς ιζ	κη	ια	ϛ ζ	β ιθ		κζ	ιβ ιη	ια ιδ	
	ε	κα	δ	η μη	ιη ια	λδ	ιη β	μη	γ κζ		κγ	ιβ κα	ι μη	
	ς	κβ	ε	θ μζ	ϛ νβ	κα μα	ιζ νγ	α λ	δ λε	κε ιη	κ	ιβ κδ	ια μβ	
	ζ	κγ	ς	ι μς	ιβ κ	μζ	μς	β ις	ε ν		ιζ	ιβ κζ	ια κθ	
	α	κδ	ζ	ια με	κδ λγ	κα νγ	μ	γ β	ζ ε		ιδ	ιβ λ	ιβ ιδ	
	β	κε	η	ιβ μδ	ε λζ	κβ ϛ	λς	μη	η κ		ια	ιβ λγ	ι ε	
	γ	κς	θ	ιγ μγ	ιζ λα	ς	λ	δ λδ	θ λς		η	ιβ λς	ι νς	
	δ	κζ	ι	ιδ μα	κθ μθ	ιβ	κδ	ε κα	ι νγ	κδ κα	δ	ιβ λθ	ια κ	
	ε	κη	ια	ιε μ	ιβ λβ	ιθ	ιη	ς β	ιβ δ	κγ λ	δ α	ιβ μ	ια μδ	
	ς	κθ	ιβ	ις λη	κε λδ	κς	ιβ	μγ	ιγ ιε	κβ λη	γ νη	ιβ μγ	ιβ δ	
	ζ	λ	ιγ	ιζ λζ	η λγ	λγ	ς	ζ κε	ιδ κζ	κα μζ	νε	ιβ μς	ιβ ϛ	
	α	λα	ιδ	ιη λε	κα μζ	μ	ιζ ϛ	η ζ	ιε λθ	νς	να	ιβ μθ	ιβ ις	
ἀπρίλλιος	β	α	ιε	ιθ λγ	ε λη	κβ μζ	ις νδ	μθ	ις να	κ ε	γ μη	ιβ νβ	ιβ νε	
	γ	β	ις	κ λβ	ιθ κβ	νδ	μζ	θ λ	ιη ζ	ιη νζ	με	ιβ νε	ιβ με	
	δ	γ	ιζ	κα λ	γ λη	κγ α	μ	ι ια	ιθ κγ	ιζ μθ	μβ	ιβ νη	ιγ ιη	
συ(νο)δός	ε	δ	ιη	κβ κη	ιη α	η	λβ	νβ	κ λη	ις μβ	λθ	ιγ α	ιγ κε	
	ς	ε	ιθ	κγ κζ	β λβ	ιε	κδ	ια λγ	κα νδ	ιε λε	λς	ιγ δ	ιγ λβ	
	ζ	ς	κ	κδ κς	ιζ κδ	κβ	ιζ	ιβ ιδ	κγ ι	ιδ κη	λγ	ιγ ζ	ιγ νγ	
	α	ζ	κα	κε κδ	β κη	κθ	ι	νε	κδ κ	νζ	λ	ιγ ι	ιδ ε	
	β	η	κβ	κς κβ	ιζ κζ	λζ	ις γ	ιγ λς	κε λ	ιγ κς	κς	ιγ ιγ	ιδ α	
	γ	θ	κγ	κζ κ	β ις	με	ιε νε	ιδ ιζ	κς μα	νε	κγ	ιγ ις	ιγ να	
	δ	ι	κδ	κη ιη	ις λβ	κγ νγ	ιε μη	ιδ νη	κζ νβ	ιβ κδ	γ κ	ιγ ιθ	ιγ η	
	ε ς		τῦρ	♂ ♐	☾ ♋	♃ ♑	♄ ♎	♆ ♑	♀ ♑	☿ ♐	☉ ♑			

συ^{δ} ὁ ε̄· ἀπρίλλιος δ̄· ὥρα β̄ η̄ τῆς μελλούσης ρ· τέλειος τόπος συνόδου ἐν ♐ κβ̄ ν̄·
ὡροσκόπος ♏ ις̄ καὶ μεσουράνημα ♌ κζ̄

a ἡμέραι τῆς ἑβδομάδος b μάρτιος c χορτάτ
d ὧραι ἡμέρας e κινήματα ☾ διακρινημένα

1 scored through 2 reading uncertain κθ or μθ

Vat Gr 210, fol.26^{v}

δεύτερον καταβατὸν

◊ ὁδὸς πρὸς τὰ ζῴδια

μοναὶ ◊	a	b	☊ ♉	♃ ♎	☿ ♈	☽ ♈	♄ ♈	☉ ♉	c	e	f
♊		□		△	♓	♓	♓		☊ νδ̄ α μθ	φάσις ἑσπερία ♓	
♋	d							♓	♃ βδ̄ β β	φάσις ἑσπερια ♑	
♋			♓	□	□	□	□		♓ νδ̄ η α	φάσις ἑσπερία ☽	
♌	ρ ιβ νζ	△						□	☽ βδ̄ ϛ α	συ^{δ} ♓ καὶ ☽	
♌			□	♓					♑ βδ̄ ϛ μα		
♌	ζ δ ϭ				△	△	△			στηριγμός ♑	
♍										☽ εἰς τὸν ♉	
♍			△								
♎	ρ δ κγ	–							◊ βδ̄ δ ε	♓ εἰς τὸν ♉	
♎				συ^{δ}			–				
♏	ζ ν ϭ				–	–		–	☊ νδ̄ α μδ	ὑποποδισμός ♑	
♏									♃ βδ̄ β δ	☽ συ^{δ} ♉	
♏			–						♓ βδ̄ ϛ δ		
♐	ρ δ								☽ βδ̄ ϛ κδ	♓ συ^{δ}	
♐		△		♓					♑ βδ̄ ϛ ι		
♐	ϛ μδ ϭ									♑ ὕπαυγος	
♑				□	△	△		△			
♑	β λ ρ	□	△				□				
♒					□	□		□		♃ ἀκρόνυκτος	
♒		♓	□	△			♓				
♓	ρ ζ				♓			♓	☊ νδ̄ α με	καῦμα ♑	
♓			♓			♓			♃ βδ̄ β ϛ		
♈	ρ ια νγ								♓ βδ̄ ϛ β	♃ – ♑	
♈		συ^{δ}					συ^{δ}		☽ βδ̄ ϛ μδ		
♉	β δ ϭ							συ^{δ}	♑ νδ̄ α κθ		
♉			συ^{δ}		συ^{δ}	συ^{δ}				συ^{δ} ☊ ☽	
♊	β κε ϭ										
♊		♓		△			♓				
♋	β μβ ϭ							♓			
♋		□	△	□	♓	♓	□			φάσις ἑῴα ♑	
		□									

a ὧραι μεταβάσεως ◊
b πρὸς ϐ σχημα(τισμοὶ) ◊
c ἀστέρων πλάτος
d ὥρα ε μθ τῆς παρελθούσης ρ
e οἱ πρὸς ἀλλήλους τῶν ἀστέρων σχηματισμοί
f οἱ δεκανοὶ

ALMANAC FOR CONSTANTINOPLE, A.D.1353 MAR 12 - APR 10

Page one

Full Moon: feria 4, Mar 20, hour 9;51 of the day.
True position of Full Moon 187;57.
Horoscope 219;0 - Midheaven 65;0.
Presentation of the table according to the the rows and columns of ephemerides.

		CALENDAR			SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY	MOTION D ELONGATIO	
		DAY	AD	AY											
1		3	12	25	359;58	82;52	50;33	199;18	24;37	22;50	19;26	34;52	12; 0	12;53	1
2		4	13	26	0;57	96;38	50;40	199; 9	25;19	24; 3	20;20	34;49	12; 2	12;39	2
3		5	14	27	1;56	110; 6	50;46	199; 1	26; 1	25;16	21;14	34;46	12; 4	12;29	3
4		6	15	28	2;55	123;33	50;53	198;53	26;43	26;29	22; 8	34;43	12; 6	12;28	4
5		7	16	29	3;54	136;53	51; 0	198;45	27;22	27;42	23; 2	34;40	12; 8	12;21	5
6		1	17	30	4;53	149;34	51; 7	198;37	28; 3	28;55	23;57	34;37	12;10	11;42	6
7	Tir	2	18	1	5;52	162; 3	51;14	198;29	28;44	30; 3	25;18	34;33	12;13	11;28	7
8		3	19	2	6;51	174; 5	51;21	198;20	29;25	31;11	25;18	34;30	12;15	11; 3	8
9	Full Moon	4	20	3	7;49	186;17	51;28	198;11	30; 7	32;19	25;18	34;27	12;18	11;14	9
10		5	21	4	8;48	198;11	51;34	198; 2	30;48	33;27	25;18	34;23	12;21	10;48	10
11		6	22	5	9;47	210;52	51;41	197;53	31;30	34;35	25;18	34;20	12;24	11;42	11
12		7	23	6	10;46	222;20	51;47	197;46	32;16	35;50	25;18	34;17	12;27	11;29	12
13		1	24	7	11;45	234;33	51;53	197;40	33; 2	37; 5	25;18	34;14	12;30	12;14	13
14		2	25	8	12;44	245;37	52; 0	197;36	33;48	38;20	25;18	34;11	12;33	10; 5	14
15		3	26	9	13;43	257;31	52; 6	197;30	34;34	39;36	25;18	34; 8	12;36	10;56	15
16		4	27	10	14;41	269;49	52;12	197;24	35;21	40;53	24;21	34; 4	12;39	11;20	16
17		5	28	11	15;40	282;32	52;19	197;18	36; 2	42; 4	23;30	34; 1	12;40	11;44	17
18		6	29	12	16;38	295;34	52;26	197;12	36;43	43;15	22;38	33;58	12;43	12; 4	18
19		7	30	13	17;36	308;33	52;33	197; 6	37;25	44;27	21;47	33;55	12;46	12; 0	19
20		1	31	14	18;35	321;47	52;40	197; 0	38; 7	45;39	20;56	33;51	12;49	12;16	20
21	April	2	1	15	19;33	335;38	52;47	196;54	38;49	46;51	20; 5	33;48	12;52	12;55	21
22		3	2	16	20;32	349;22	52;54	196;47	39;30	48; 7	18;57	33;45	12;55	12;45	22
23		4	3	17	21;30	3;38	53; 1	196;40	40;11	49;23	17;49	33;42	12;58	13;18	23
24	New Moon	5	4	18	22;38	18; 1	53; 8	196;32	40;52	50;38	16;42	33;39	13; 1	13;25	24
25		6	5	19	23;27	32;32	53;15	196;24	41;33	51;44	15;35	33;36	13; 4	13;32	25
26		7	6	20	24;26	47;34	53;22	196;17	42;14	53;10	14;28	33;33	13; 7	13;53	26
27		1	7	21	25;24	62;28	53;29	196;10	42;55	54;20	13;57	33;30	13;10	14; 5	27
28		2	8	22	26;22	77;27	53;37	196; 3	43;36	55;30	13;26	33;27	13;13	14; 1	28
29		3	9	23	27;20	92;16	53;45	195;55	44;17	56;41	12;55	33;23	13;16	13;51	29
30		4	10	24	28;18	106;32	53;53	195;48	44;58	57;52	12;24	33;20	13;19	13; 8	30

New Moon: feria 5, Apr 4, hour 2;8 of the next night.
True position of New Moon 22;50.
Horoscope 136;0 - Midheaven 147;0.

ALMANAC FOR CONSTANTINOPLE, A.D.1353 MAR - APR

SOURCE: ZIJ-I ILKHANI
16.00 DEGREES WEST, LATITUDE = 41.5, OBLIQUITY = 23;35.

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY	MOTION IN ELONGATION
1	359:57.7	82:25.6	50:46.1	199:11.1	25:19.8	23: 7.8	19:48.9	34:52.7	11:59.9	13:17.4
2	0:56.7	96:12.0	50:52.1	199: 4.4	26: 3.2	24:21.0	20:46.7	34:49.6	12: 2.7	12:47.3
3	1:56.0	109:43.5	50:58.1	198:57.5	26:46.6	25:34.3	21:40.1	34:46.4	12: 5.5	12:32.3
4	2:55.0	123:10.1	51: 4.3	198:50.5	27:29.9	26:47.4	22:28.3	34:43.2	12: 8.3	12:27.6
5	3:53.9	136:20.9	51:10.4	198:43.5	28:13.1	28: .4	23:11.1	34:40.0	12:11.2	12:11.9
6	4:53.1	149: 8.7	51:16.7	198:36.4	28:56.3	29:13.5	23:48.5	34:36.9	12:14.0	11:48.6
7	5:51.9	161:33.9	51:23.0	198:29.2	29:39.5	30:26.5	24:19.7	34:33.7	12:16.8	11:26.3
8	6:50.8	173:51.4	51:29.4	198:21.9	30:22.6	31:39.4	24:44.5	34:30.5	12:19.6	11:18.7
9	7:49.8	186: 2.4	51:35.8	198:14.6	31: 5.7	32:52.3	25: 3.0	34:27.3	12:22.4	11:12.0
0	8:48.6	198: 7.4	51:42.3	198: 7.2	31:48.8	34: 5.3	25:14.3	34:24.1	12:25.2	11: 6.2
1	9:47.3	210: 4.3	51:48.9	197:59.8	32:31.8	35:18.0	25:18.6	34:21.0	12:28.0	10:58.2
2	10:46.2	221:48.0	51:55.5	197:52.2	33:14.8	36:30.8	25:15.8	34:17.8	12:30.8	10:44.8
3	11:44.9	233:26.9	52: 2.2	197:44.7	33:57.7	37:43.5	25: 5.4	34:14.6	12:33.5	10:40.2
4	12:43.5	245: 6.3	52: 8.9	197:37.2	34:40.5	38:56.0	24:47.6	34:11.4	12:36.3	10:40.7
5	13:42.4	257: 1.0	52:15.7	197:29.5	35:23.4	40: 8.7	24:23.5	34: 8.3	12:39.1	10:55.9
6	14:40.9	269:23.6	52:22.5	197:21.9	36: 6.2	41:21.2	23:51.7	34: 5.1	12:41.8	11:24.0
7	15:39.5	282:10.8	52:29.4	197:14.2	36:49.0	42:33.6	23:13.5	34: 1.9	12:44.6	11:48.6
8	16:38.2	295: 2.5	52:36.4	197: 6.5	37:31.7	43:46.1	22:29.8	33:58.7	12:47.3	11:53.0
9	17:36.7	308: 2.8	52:43.4	196:58.8	38:14.4	44:58.4	21:40.7	33:55.5	12:50.1	12: 1.8
0	18:35.1	321:19.6	52:50.4	196:51.1	38:57.0	46:10.6	20:47.5	33:52.4	12:52.8	12:18.4
1	19:33.7	335: .6	52:57.5	196:43.4	39:39.6	47:23.0	19:51.8	33:49.2	12:55.5	12:42.4
2	20:32.1	349: 3.0	53: 4.7	196:35.7	40:22.2	48:35.1	18:53.9	33:46.0	12:58.3	13: 4.1
3	21:30.4	3:20.2	53:11.9	196:28.0	41: 4.6	49:47.3	17:55.5	33:42.8	13: 1.0	13:18.8
4	22:29.0	17:43.6	53:19.1	196:20.3	41:47.2	50:59.5	16:58.4	33:39.7	13: 3.7	13:24.9
5	23:27.2	32:21.4	53:26.4	196:12.7	42:29.6	52:11.5	16: 2.9	33:36.5	13: 6.4	13:39.5
6	24:25.5	47:10.7	53:33.7	196: 5.1	43:11.9	53:23.4	15:11.3	33:33.3	13: 9.0	13:51.1
7	25:23.9	62:10.4	53:41.1	195:57.5	43:54.3	54:35.4	14:23.8	33:30.1	13:11.7	14: 1.3
8	26:22.1	77:11.7	53:48.5	195:49.9	44:36.6	55:47.2	13:41.1	33:27.0	13:14.4	14: 3.1
9	27:20.2	91:53.8	53:55.9	195:42.4	45:18.9	56:58.9	13: 4.3	33:23.8	13:17.0	13:44.0
0	28:18.6	106:10.2	54: 3.4	195:34.9	46: 1.1	58:10.7	12:34.5	33:20.6	13:19.6	13:18.0

ALMANAC FOR CONSTANTINOPLE, BEGINNING A.D.1353 MAR 12

SOURCE: ZIJ-I ALA'I
8.00 DEGREES WEST

	SUN	MOON	SATURN	JUPITER	MARS	VENUS	MERCURY	NODE	DAY	MOTION I ELONGATI
1	0:39.5	82:51.6	50:48.0	197:48.2	26: 3.3	23:44.7	20:27.6	34:52.7	12: 1.9	13:21.8
2	1:38.5	96:34.5	50:54.1	197:41.3	26:46.7	24:57.8	21:17.8	34:49.5	12: 4.7	12:43.8
3	2:37.5	110: 5.8	51: .2	197:34.2	27:29.9	26:11.0	22: 2.7	34:46.3	12: 7.5	12:32.3
4	3:36.7	123:32.1	51: 6.3	197:27.1	28:13.2	27:24.2	22:42.5	34:43.1	12:10.3	12:27.1
5	4:35.7	136:43.0	51:12.6	197:19.9	28:56.3	28:37.2	23:16.0	34:40.0	12:13.1	12:12.0
6	5:34.6	149:30.9	51:18.9	197:12.7	29:39.4	29:50.1	23:43.4	34:36.8	12:15.9	11:49.0
7	6:33.7	161:59.7	51:25.2	197: 5.3	30:22.5	31: 3.2	24: 4.5	34:33.6	12:18.8	11:29.7
8	7:32.5	174:13.8	51:31.6	196:57.9	31: 5.6	32:16.1	24:19.1	34:30.4	12:21.6	11:15.2
9	8:31.3	186:24.8	51:38.1	196:50.5	31:48.6	33:28.9	24:26.1	34:27.2	12:24.4	11:12.2
10	9:30.3	198:30.0	51:44.7	196:43.0	32:31.6	34:41.9	24:26.3	34:24.1	12:27.2	11: 6.1
11	10:29.0	210:27.2	51:51.3	196:35.5	33:14.5	35:54.7	24:18.8	34:20.9	12:29.9	10:58.5
12	11:27.7	222:14.6	51:57.9	196:27.9	33:57.3	37: 7.3	24: 3.9	34:17.7	12:32.7	10:48.7
13	12:26.6	233:53.8	52: 4.7	196:20.3	34:40.2	38:20.1	23:42.1	34:14.5	12:35.5	10:40.3
14	13:25.3	245:30.0	52:11.4	196:12.7	35:22.9	39:32.6	23:12.8	34:11.4	12:38.3	10:37.6
15	14:23.8	257:24.4	52:18.3	196: 5.0	36: 5.8	40:45.1	22:36.9	34: 8.2	12:41.0	10:55.9
16	15:22.6	269:46.4	52:25.2	195:57.3	36:48.5	41:57.7	21:55.3	34: 5.0	12:43.8	11:23.2
17	16:21.2	282:33.3	52:32.1	195:49.6	37:31.2	43:10.1	21: 7.9	34: 1.8	12:46.5	11:48.3
18	17:19.7	295:29.0	52:39.1	195:41.9	38:13.7	44:22.4	20:16.0	33:58.7	12:49.3	11:57.2
19	18:18.4	308:25.7	52:46.1	195:34.2	38:56.4	45:34.9	19:21.1	33:55.5	12:52.0	11:58.0
20	19:16.8	321:42.5	52:53.2	195:26.5	39:38.9	46:47.1	18:23.5	33:52.3	12:54.8	12:18.4
21	20:15.2	335:23.4	53: .3	195:18.8	40:21.5	47:59.3	17:25.0	33:49.1	12:57.5	12:42.5
22	21:13.6	349:25.7	53: 7.5	195:11.2	41: 3.9	49:11.4	16:26.7	33:45.9	13: .2	13: 4.0
23	22:11.9	3:42.7	53:14.7	195: 3.5	41:46.3	50:23.6	15:30.0	33:42.8	13: 2.9	13:18.7
24	23:10.6	18:10.2	53:22.0	194:55.8	42:28.8	51:35.9	14:37.0	33:39.6	13: 5.6	13:28.7
25	24: 8.9	32:43.4	53:29.3	194:48.2	43:11.1	52:47.9	13:47.1	33:36.4	13: 8.3	13:35.0
26	25: 7.2	47:32.2	53:36.7	194:40.7	43:53.3	53:59.8	13: 2.1	33:33.2	13:10.9	13:50.6
27	26: 5.4	62:31.3	53:44.1	194:33.2	44:35.7	55:11.6	12:22.8	33:30.1	13:13.6	14: .9
28	27: 3.5	77:32.2	53:51.5	194:25.7	45:17.8	56:23.4	11:49.8	33:26.9	13:16.2	14: 2.7
29	28: 1.7	92:18.4	53:59.0	194:18.3	45:60.0	57:35.1	11:23.7	33:23.7	13:18.9	13:48.1
30	29: .3	106:35.0	54: 6.5	194:10.9	46:42.2	58:47.0	11: 5.5	33:20.5	13:21.5	13:18.0

CONCLUSIONS

CONCLUSIONS

The intention of this work is to provide an edition of the almanac for 1336-7 which is included in the collection of the works of the Chartophylax of Trebizond Andreus Libadenus, to carry out an analysis of the work so to show the nature of the quantities tabulated, and then to determine the source, that is the astronomical handbook on the basis of which the calculations were made.

Each month in the almanac is represented by two pages open to the user. On the left are tabulated the Roman and Arabic dates, all the true longitudes, from the Sun to the lunar node, and the length of the day. On the right one finds the times of the passage of the Moon into the zodiacal signs, the configurations of the Moon with respect to the Sun and the planets (opposition, trigonal, etc), and finally the phases of the planets in relation to the Sun (retrogradations, etc.).

Common experience of Byzantine astronomical material would naturally suggest that Ptolemy's Almagest or his Handy Tables would be the source. However a few simple calculations, of the node, or of the Sun, for example, would suffice to show a wide divergence from Ptolemy. Moreover, as we know from recent researches, a considerable amount of Arabic and Persian astronomical material had come through Trebizond into the Byzantine culture area. In view of that, both the Zīj-i Īlkhānī and the Zīj al-'Alā'ī are obvious candidates as the source.

The analysis of the material is greatly assisted by graphical presentations. In a series of graphs of the tabulated positions one can see at a glance the courses of the various true longitudes, and their relations with the Sun. The equations of motion are also presented graphically. The equation which forms part of the true longitude can be isolated if one subtracts the mean longitude. However, in ignorance of the source one can only experiment. As many as six zījes are tried, in each case the mean longitude being subtracted from the longitude given in the almanac. If the resulting equation is identical to that given in the zīj itself, this is a clear confirmation. Graphical presentations are given of both equations, for both the Zīj-i Īlkhānī and the Zīj al-'Alā'ī, so that one can see at a glance the goodness of fit.

As it happens the former is established as the primary source, but with the

reservation that certain changes in the parameters for the Moon, Jupiter and Saturn were imposed, details of which are given in section 4.3. The Moon may have been based on the Zīj al-'Alā'ī. As a part of the determination of the source we also fix the shift in the meridian of reference from that of the zīj to Trebizond, viz 12 degrees West of Marāghah, so that Trebizond was placed at 70 on the Ptolemaic longitude scale. The correct shift from Shirwān, the prime meridian of the Zīj al-'Alā'ī, is 4, not 14, degrees, showing again that the users of that zīj confused the Ptolemaic and Khwārizmian scales.

From the tabulation of the length of day, one can hope to determine the best values for the obliquity and the latitude of the site. In fact this data is too noisy to allow the obliquity to be fixed. In the Zīj-i Īlkhānī the obliquity is 23;30, while in the Persian Syntaxis it is 23;35. One can show that the latitude must have been taken as either 42 or 43 degrees. These values of the change of meridian and of the latitude indicate that the position of Trebizond was taken in all probability according to Ptolemy's Handy Tables or his Geography.

The edition is not 'critical' in the strict sense of a determination of the text through a collation of various manuscripts, because the manuscript source is unique. It is possible however to isolate errors of various kinds. It is obvious for example that in the calendrical column there are discrepancies from the correct Arabic calendar. The graphical representation moreover assists substantially, drawing attention, for example, to the fact that a portion of the solar positions in the first month were copied into the second month. This is enough to prove that this copy was not made by the original calculator, who certainly would have noticed such a slip, but that it was made by a copyist. This is the case even though this copy is made on paper which is essentially contemporary with the composition.

The times and configurations given in the right hand pages of the almanac have been calculated from the entries given on the left hand pages. Some discrepancies appear, both in the time of the configuration and in the zodiacal sign. The planetary phases are correctly noted almost without exception.

The work is anonymous, but a review of the circumstances of astronomical activity in Trebizond, especially of the work of Chrysococces, shows with high probability, that the author is the priest Manuel who transmitted the new Persian material from Chioniades to Chrysococces; the latter indeed credits him

with having composed just such an almanac.

Chrysococces, in his Persian Syntaxis, describes the procedure for the construction of such a work. In one important manuscript of the Syntaxis, Vat.gr.210, there is one page of such an almanac, for March-April 1353. This is probably not the work of Chrysococces himself, rather it is to be assumed that it was made by a later owner of this copy. Here as in the Almanac for 1336, there are problems concerning the calculation of the position of the Moon, explained in detail above.

PARAMETERS OF ZIJES

PARAMETERS OF ZIJES

In this section one will find in tabular form all the parameters of the various zījes which were tried as possible sources of the Almanac. The sources for these parameters are discussed and listed in sec.4.1 of the commentary.

Zīj al-'Adūdī

	radix at 2197050.0	motion in 365 days
Sun	357;58,41	359;45,40 21
$\Gamma_{\odot}$	89; 5,18,59,17	1/70
Moon	289; 9,44	13^{r} 129;23, 2,17
apogee	172;20,27	40;40
node	-78;20, 8	-19;19,43, 3
Mercury	241;40	4^{r} 53;42,23
$\Gamma_{☿}$	226;55,19, 1,28	1/70
Venus	371;35,46	1^{r} 224;47,26,59
$\Gamma_{♀}$	75;55,18,59,49	1/70
Mars	181; 5,41	191;17,10,51
$\Gamma_{♂}$	136; 5,18,59,16	1/70
Jupiter	118;45,42	30;20,34,40
$\Gamma_{♃}$	180;57,18,59,43	1/70
Saturn	163;47,41	12;13,35,48
$\Gamma_{♄}$	256;55,18,58,11	1/70

Parameters of equations

	Equation of argument		Equation of centre	
	M	maximum	S	maximum
Sun			0; 2, 5,48	2; 0,10
Moon	0;10,19,29	13; 9	0; 5, 6,27,27	4;53
Mercury	0; 3,50,27	3;40	0;22,49,55	22;22
Venus	0; 2, 4,38	1;59	0;43, 8,53	45;59
Mars	0;11,59,43	11;25	0;40,15,52	42; 9
Jupiter	0; 5,47,56	5;32	0;11,30	11; 3
Saturn	0; 6, 4,44	5;48	0; 6,29,50	6;13

	radix at 1948440.0	daily motion
Sun	116; 0,25	0;59, 8,20,33,53, 4,29,40
$\Gamma_{\odot}$	78;20	1/(66 × 365)
Moon	145; 3,40	13;10,35, 2, 0,41,28,38,50
apogee	193;10, 5	0; 6,41, 5,48, 7,17,11,20
node	-233;52,34	-0; 3,10,37,47,51, 2,50,50
Mercury	192; 2,30	4; 5,32,27,43,32,36,15,30
$\Gamma_{\☿}$	198; 4,59,58	1/(66 × 365)
Venus	161;53,20	1;36, 7,49,16,55,42, 8, 0
$\Gamma_{♀}$	64;35	1/(66 × 365)
Mars	212; 8,31	0;31,26,39,36,34, 5,16,50
$\Gamma_{♂}$	124; 5	1/(66 × 365)
Jupiter	331; 7, 9	0; 4,59,16,19,53,47,11,20
$\Gamma_{♃}$	168;35	1/(66 × 365)
Saturn	116;33,52	0; 2, 0,36, 4,43, 2, 8, 0
$\Gamma_{♄}$	240;35	1/(66 × 365)

Parameters of equations

	Equation of argument		Equation of centre	
	M	maximum	S	maximum
Sun			0; 2,18,35,50	2;12,23
Moon	0;10,19,29	13; 9	0; 5,14,48	5; 1
Mercury	0; 3,10,38	3; 2	0;22,30,31	22; 2
Venus	0; 2,29,46	2;23	0;43, 8,54	45;59
Mars	0;11,59,43	11;25	0;39,28,55	41; 9
Jupiter	0; 5,30, 6	5;15	0;11,30	11; 4
Saturn	0; 6,49,54	6;31	0; 6,29,50	6;13

Zīj-i 'Alā'ī

	radix at 2149163.0	motion in 30 days
Sun	318;49,41,19	29;34,10,17,43,30
Γ_{σ}	87;50,42,36	30/(66 ×365)
Moon	31;50,29,46	1^{r} 35;17,30,57,45,54
apogee	236;32,54, 1	3;20,32,48,49,54,30
node	-62;24,41,57	-1;35,18,47,44,39,30
Mercury	126;24,53,31	122;46,21,21,42
Γ_{Q}	209;59,42,59	30/(66 ×365)
Venus	274;48,58,23	48; 3,54,39,13,18,49
Γ_{Q}	75;54,42,59	30/(66 ×365)
Mars	285;40, 1,22	15;43,19,55,40,30
Γ_{σ}	134;43,42,59	30/(66 ×365)
Jupiter	96;50, 2,20	2;29,37,49,50,30
Γ_{4}	177;43,42,59	30/(66 ×365)
Saturn	1;33,19	1; 0,18, 2,16,46,30
Γ_{h}	248; 1,42,59	30/(66 ×365)

Parameters of equations

	Equation of argument		Equation of centre	
	M	maximum	S	maximum
Sun			0; 2, 4, 46	1;59,10
Moon	0;10,18,57	13; 8	0; 5,13, 46	5;0
Mercury	0; 3,10,38	3; 1	0;22,30,31	22; 2
Venus	0; 2, 4,38	1;59	0;43, 8,54	45;59
Mars	0;12,59,43	11;25	0;39,28,55	41; 9
Jupiter	0; 5,30, 6	5;15	0;11,30	11; 3
Saturn	0; 6,49,54	6;31	0; 6,29,50	6;13

Zīj-i Īlkhānī

	radix at 2171063.0	motion in 100x365 days
Sun - $\Gamma_{\odot}$	215;36,15	99^{r} 334;41, 3
$\Gamma_{\odot}$ -2;0,30	86;24,21	100/70
Moon -7;40	226;46,22	1335^{r} 338;23,18
Moon-apogee -13; 8	245; 1,27	1324^{r} 231;52,28
Node	218; 5,34	-5^{r} 132;51,44
Mercury-Sun +4;0	164;50, 0	314^{r} 357; 4,24
Sun-$\Gamma_{\mathrm{Ø}}$ -4;0	88;55,56	99^{r} 334;41, 3
$\Gamma_{\mathrm{Ø}}$	211; 5,10	100/70
Venus-Sun +2;0	140; 8,22	62^{r} 182;57,44
Sun-Γ_{Q} -2;0	224;20,56	99^{r} 334;41, 3
Γ_{Q}	77;40,10	100/70
Mars-Γ_{σ} -12;0	96; 0,54	53^{r} 47;12,22
Sun-Mars +12;0[a]	73;10, 5	46^{r} 287;28,41
Γ_{σ}	134;30, 8	100/70
Jupiter-$\Gamma_{\mathrm{Ц}}$ -18;0	282;43,14	8^{r} 152;52, 4
Sun-Jupiter +6;0	191;38, 1	91^{r} 181;49, 0
$\Gamma_{\mathrm{Ц}}$	177;40,43	100/70
Saturn-Γ_{Ω} -14;0	112;19,38	3^{r} 141;20, 3
Sun-Saturn +7;0[a]	295;48,19	96^{r}193;21,40
Γ_{Ω}	248;53, 9	100/70

Note a. The terms +12, +7 were printed incorrectly as -12, +6 in Mercier (1984), p.55.

Parameters of equations

	Equation of argument		Equation of centre	
	M	Maximum	S	Maximum
Sun			0; 2, 6, 9,41	2; 0,30
Moon	0;10,18,57	13; 8	0; 5,14,48	5; 1
Mercury	0; 3,10,38	3; 2	0;22,29,33	22; 1
Venus	0; 2, 4,38	1;59	0;43, 8,54	45;59
Mars	0;11,59,43	11;25	0;40,18,12	42;12
Jupiter	0; 5,30, 5	5;15	0;11,30	11; 3
Saturn	0; 6,50,57	6;32	0; 6,29,50	6;13

Tāj al-Azyāj

	radix at 1948438.0	daily motion
Sun	114; 0,31	0;59, 8,20, 8, 4,37
☌ ☉	79; 6,40,55	1/(66 × 365)
Moon	119;42, 7	13;10,35, 1,36,32,17
apogee	193;35,35	0; 6,41, 5, 7, 5,10
node	-232;30,44	-0; 3,10,38,58,42,48
Mercury	192;13,23,51	4; 5,32,28,19, 8,38
☌ ☿	216; 5,53,55,28	1/(66 × 365)
Venus	157;42,23	1;36, 7,49, 4,41,37
☌ ♀	62;20,53,55,28	1/(66 × 365)
Mars	211;45,20	0;31,26,38,16, 2,26
☌ ♂	127;17,23,55,15	1/(66 × 365)
Jupiter	331;42, 9	0; 4,59,14,46,58,13
☌ ♃	168; 3,43,57,22	1/(66 × 365)
Saturn	111;30,48	0; 2, 0,41,31,59,54
☌ ♄	248;46, 6,54,24	1/(66 × 365)

Parameters of equations

	Equation of argument		Equation of centre	
	M	maximum	S	maximum
Sun			0; 2, 5,59	2; 0,20
Moon	0;10,19,29	13;9	0; 5, 4,22	4;51
Mercury	0; 3,33,41	3;24	0;22,59,36	22;32
Venus	0; 2, 5,41	2; 0	0;43, 8,54	45;59
Mars	0;12,15,35	11;40	0;39,53,16	41;40
Jupiter	0; 5,30, 6	5;15	0;11,37,11	11;10
Saturn	0; 6,49,54	6;31	0; 6,29,50	6;13

Adwār al-Anwār

	radix at 2171062.0	daily motion
Sun	303; 0,14	0;59, 8,20, 8, 4,37
$\Gamma_{☉}$	88;20,47, 0	1/(66 × 365)
Moon	221;14,20	13;10,35, 1,52,46,45
apogee	152; 1,21	0; 6,41, 5,19, 1,48
node	-142; 4,46	-0; 3,10,37,37,12,20
Mercury	96; 1, 5	4; 5,32,27, 7,46,58
$\Gamma_{☿}$	225;19,59,58,54	1/(66 × 365)
Venus	79; 9,18	1;36, 7,49,15,53,38
$\Gamma_{♀}$	71;35; 0, 0,33	1/(66 × 365)
Mars	242; 8, 3,	0;31,26,39,44,40,48
$\Gamma_{♂}$	136;31,29,58,40	1/(66 × 365)
Jupiter	117;53,13	0; 4,59,16,40,55, 8
$\Gamma_{♃}$	177;17,50, 0,48	1/(66 × 365)
Saturn	15;37,53	0; 2, 0,36,45,35,41
$\Gamma_{♄}$	258; 0,12,57,49	1/(66 × 365)

Parameters of equations

	Equation of argument		Equation of centre	
	M	maximum	S	maximum
Sun			0; 2, 6,01	2; 0,22
Moon	0; 9, 0, 6	10;51	0; 5,11,40,27	4;58
Mercury	0; 3,10,38	3; 2	0;22,30,32	22; 2
Venus	0; 2, 5,40	2; 0	0;43, 9,37	46; 0
Mars	0;11,59,43	11;25	0;39,37,34	41;20
Jupiter	0; 5,30, 6	5;15	0;11,30	11; 3
Saturn	0; 6,31,59	6;13	0; 6,19,26	6; 3

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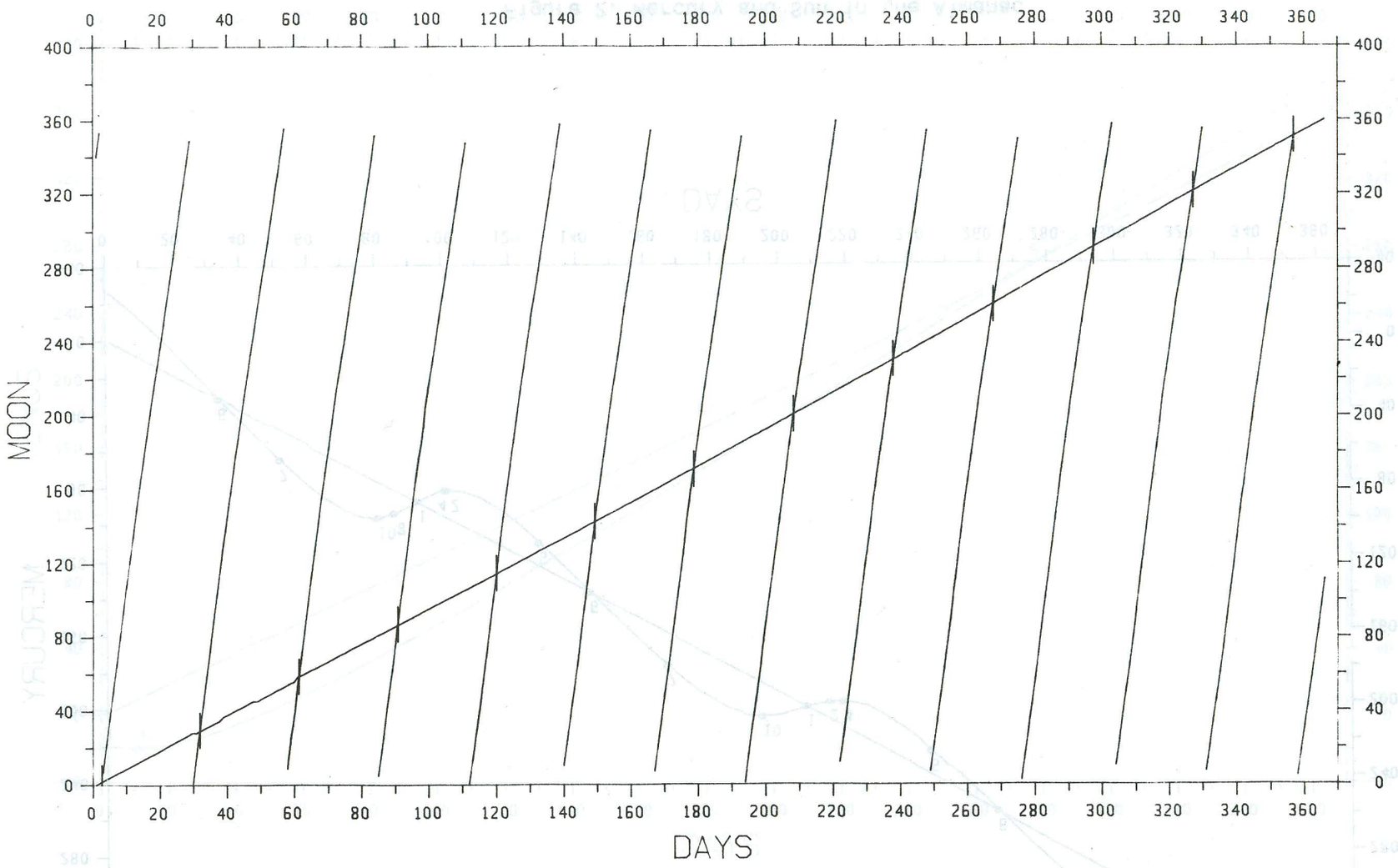


Figure 1. Moon and Sun in the Almanac

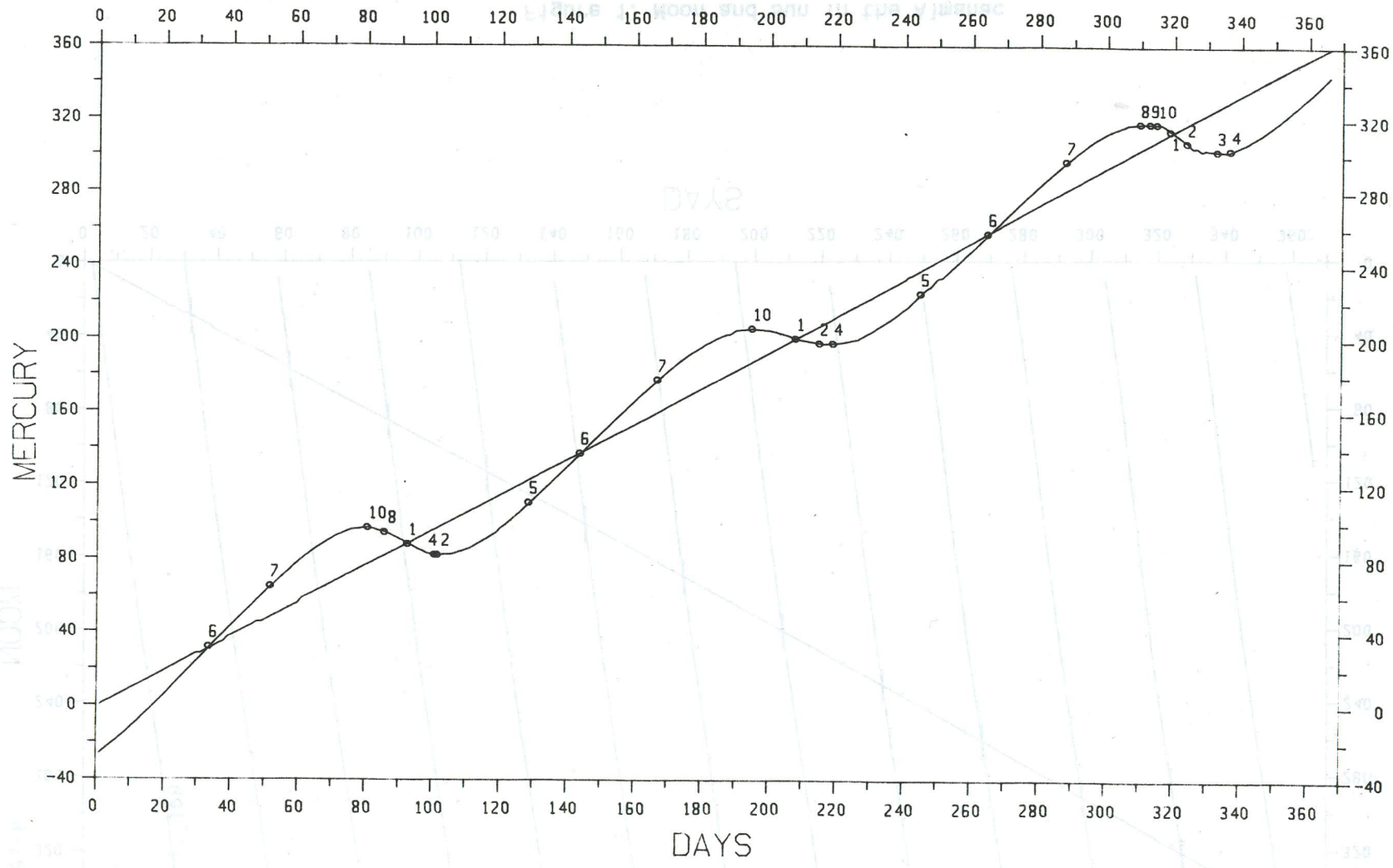
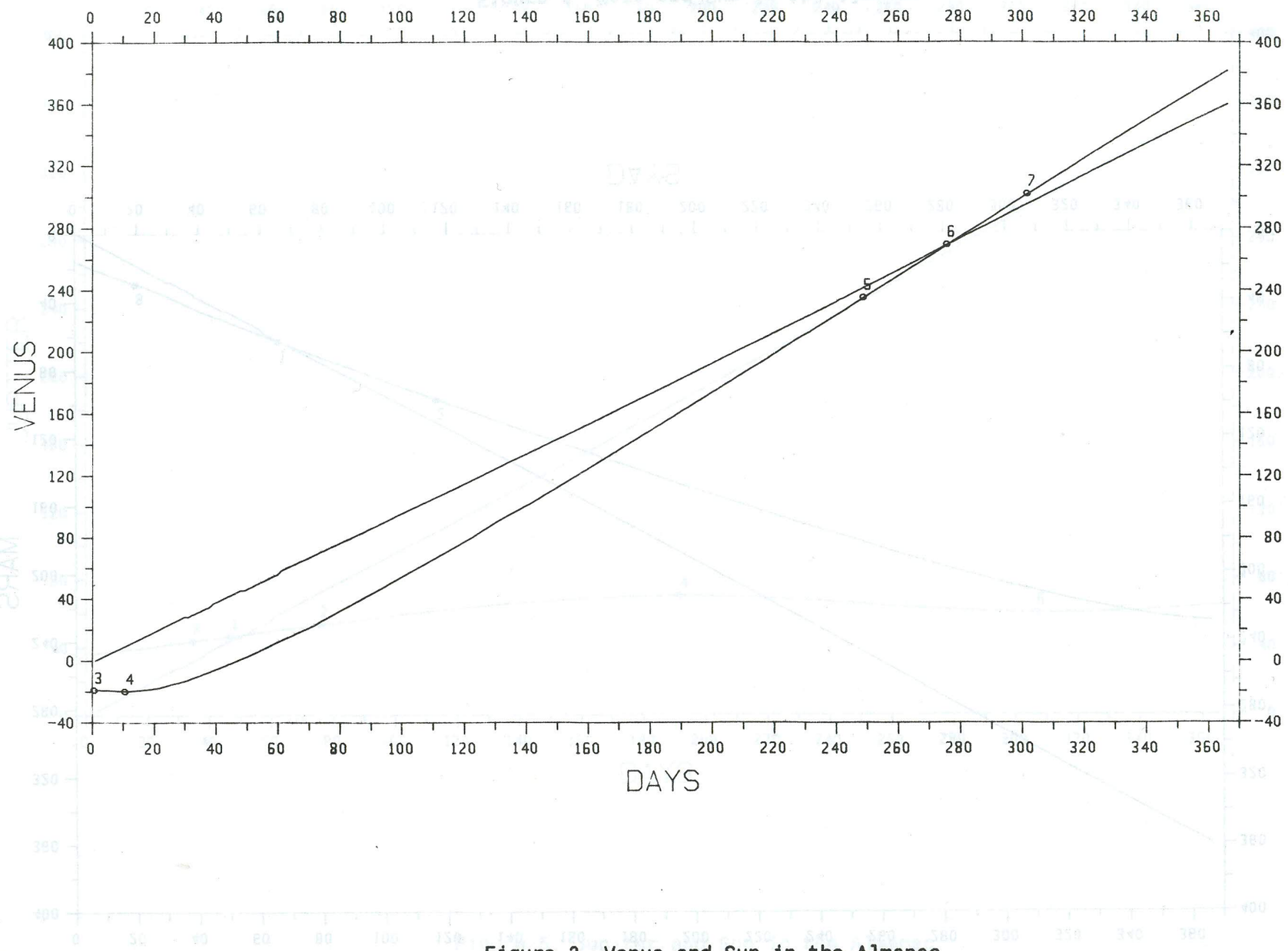


Figure 2. Mercury and Sun in the Almanac



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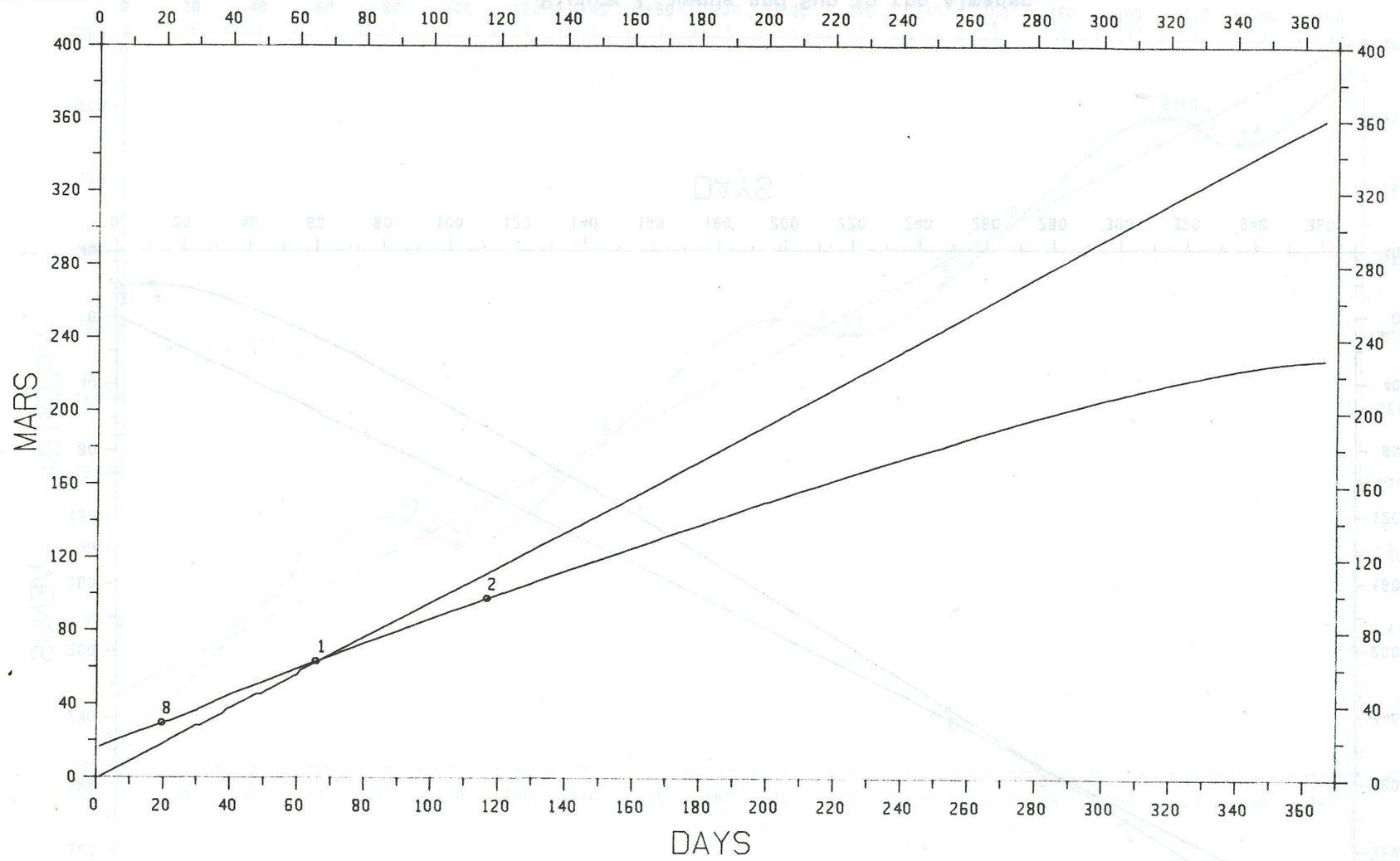

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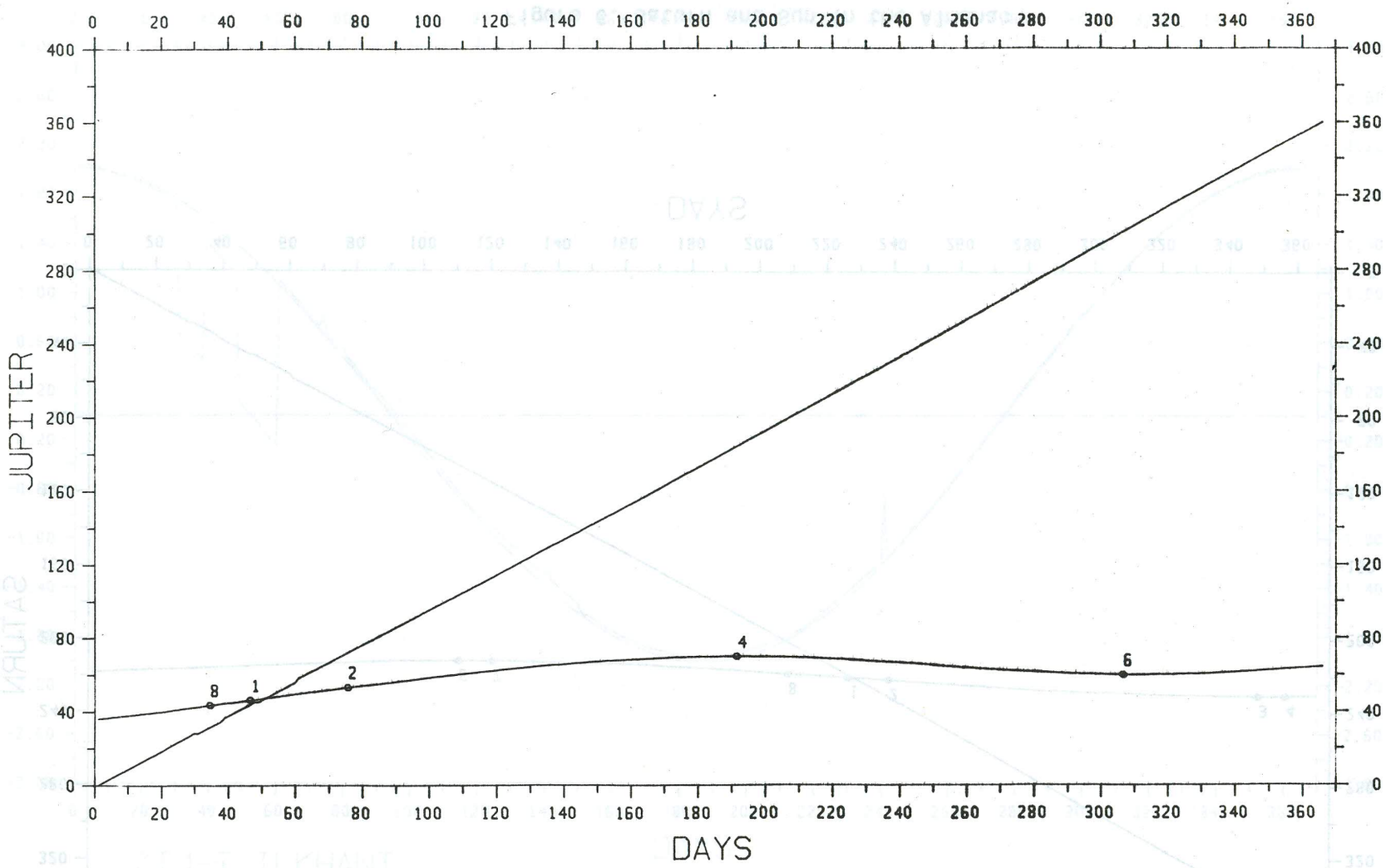
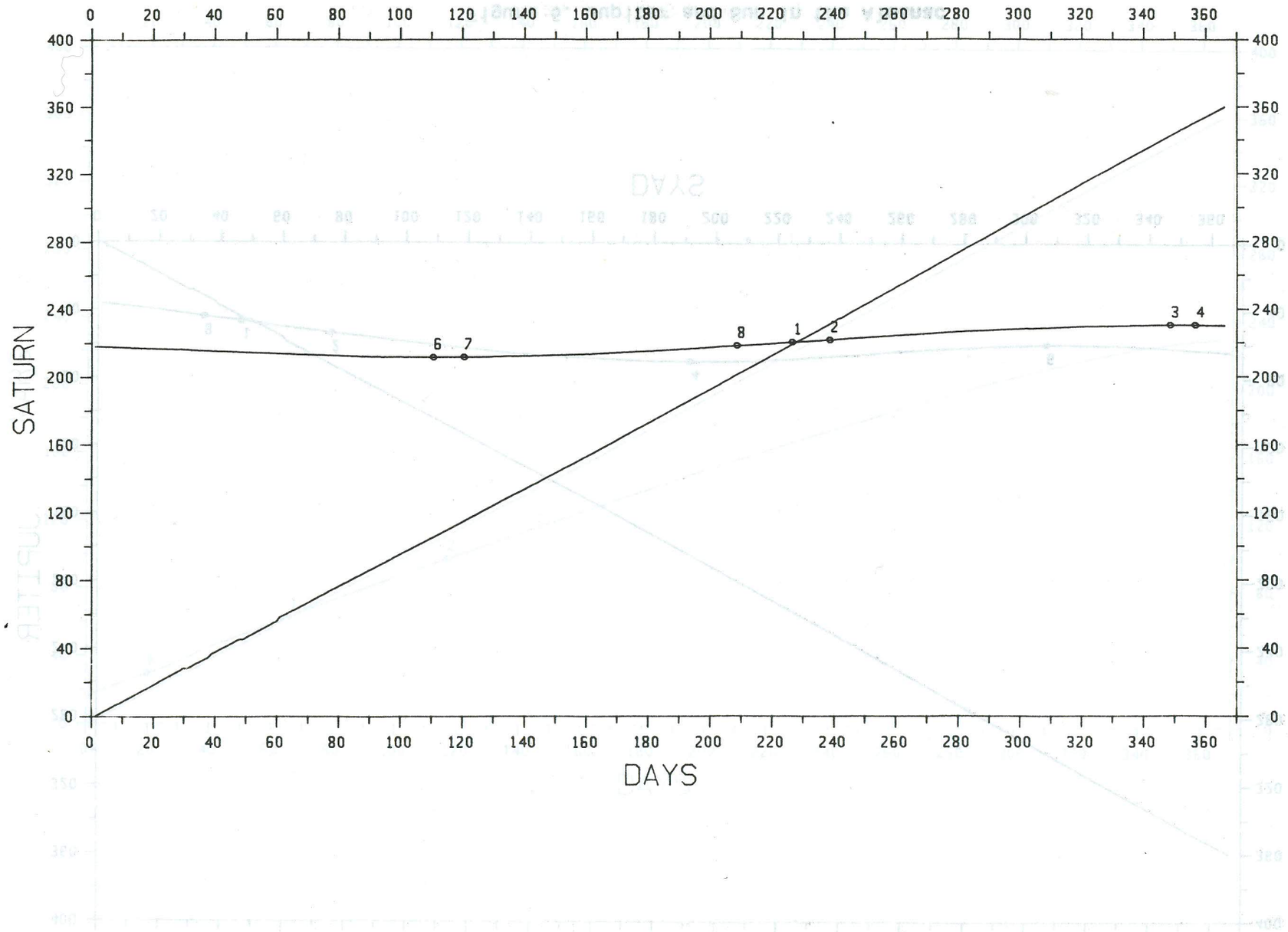


Figure 5. Jupiter and Sun in the Almanac



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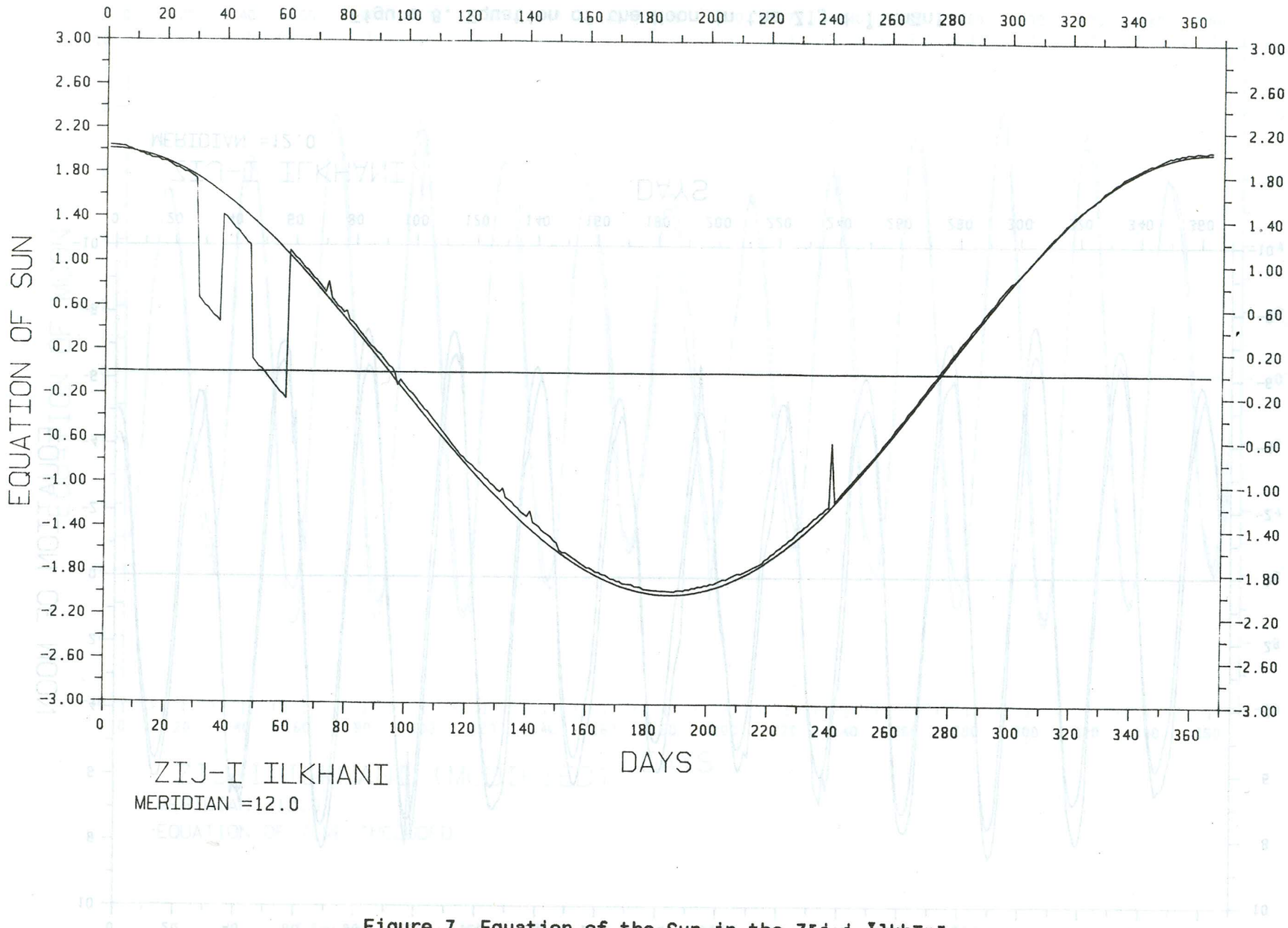


Figure 7. Equation of the Sun in the Zīj-i Īlkhānī

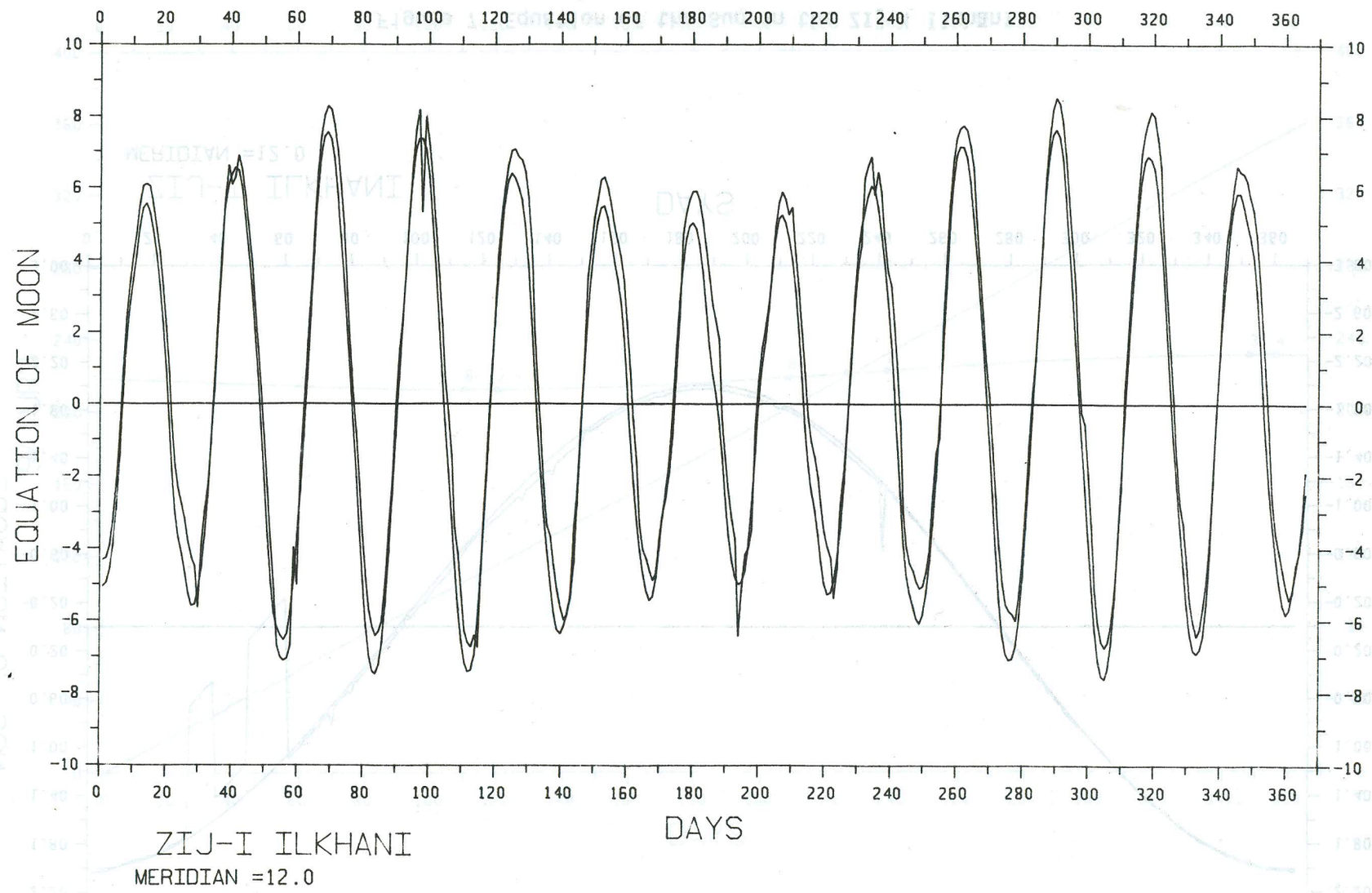
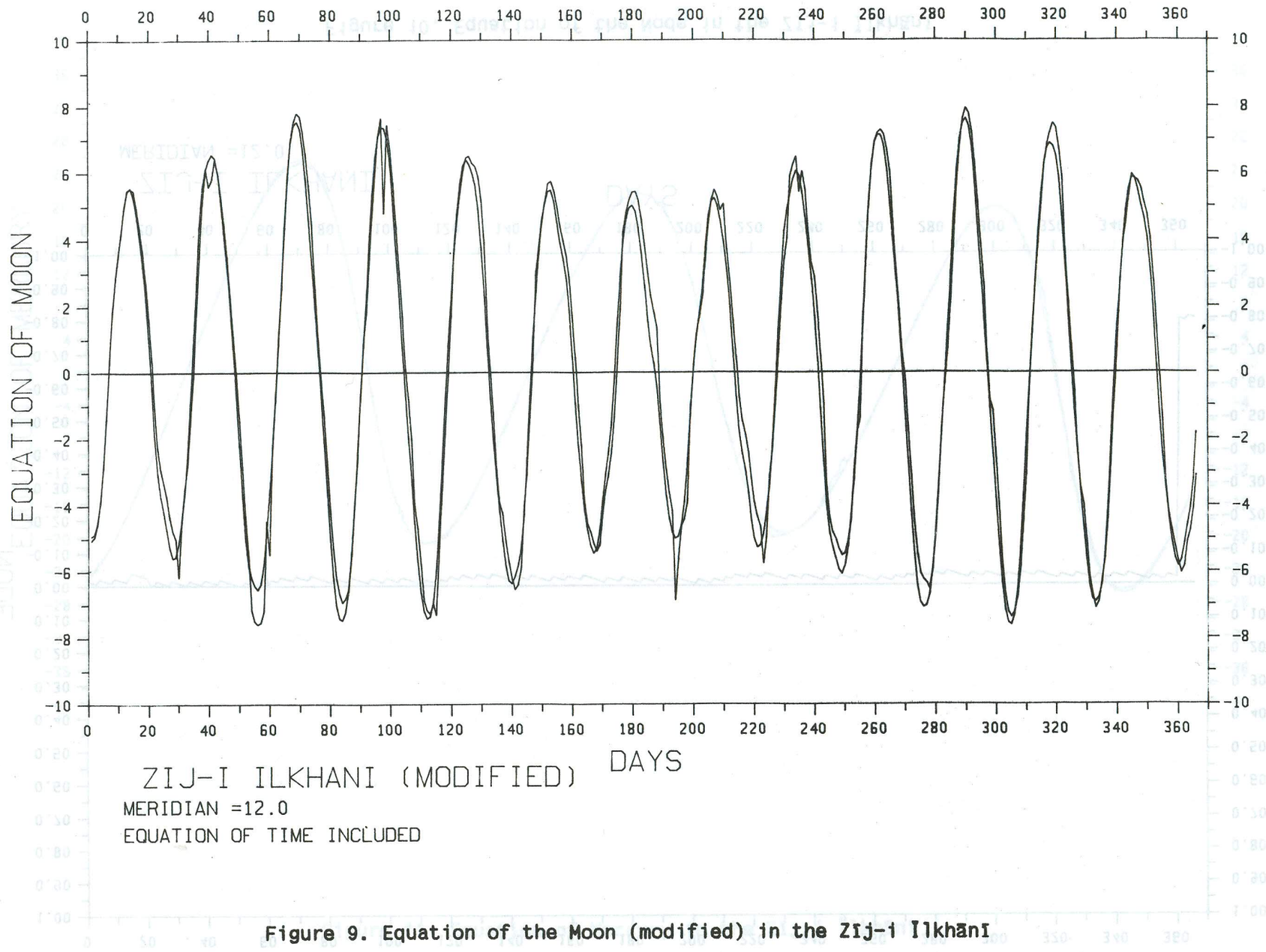


Figure 8. Equation of the Moon in the Zīj-i Īlkhānī



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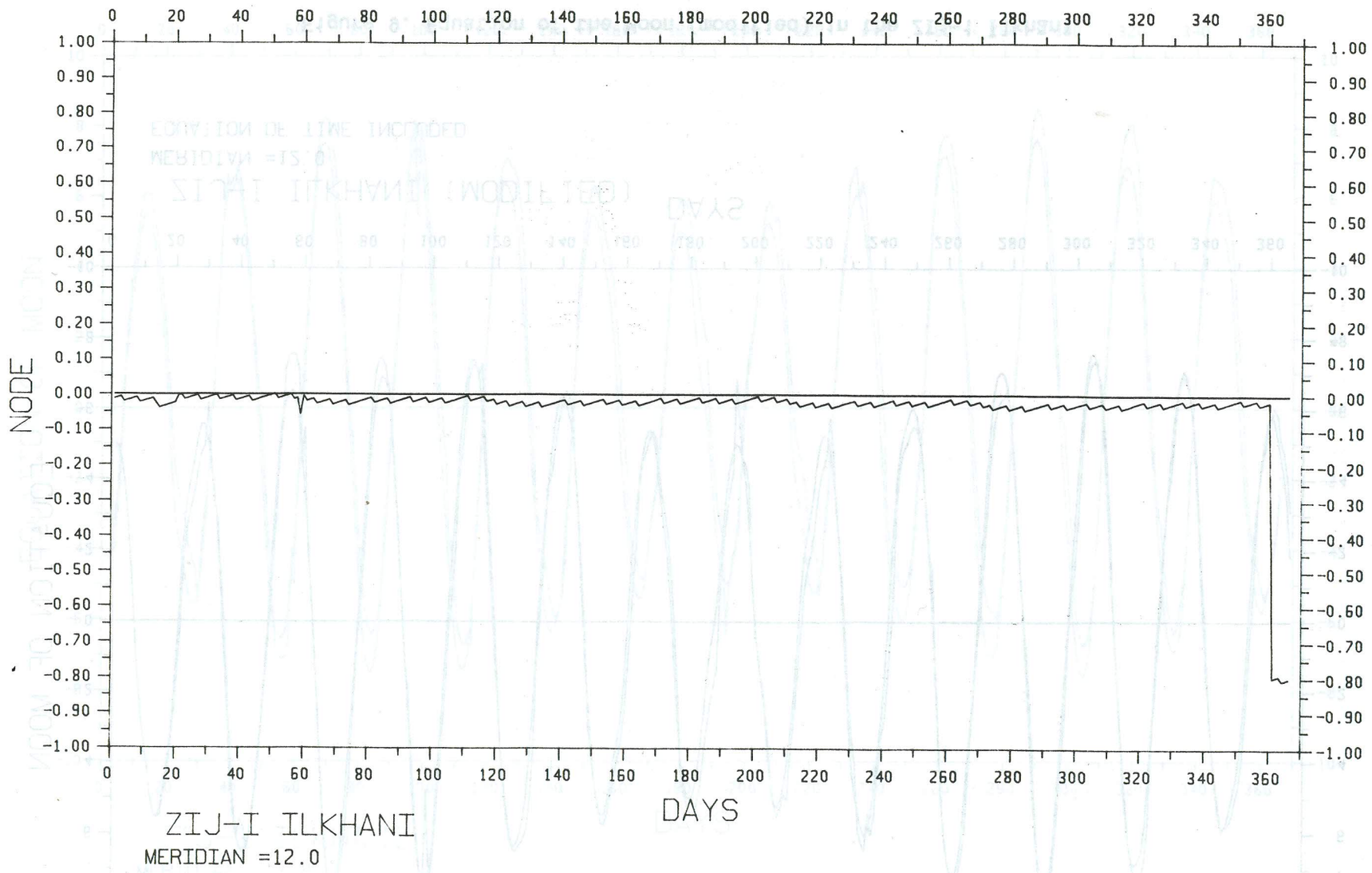

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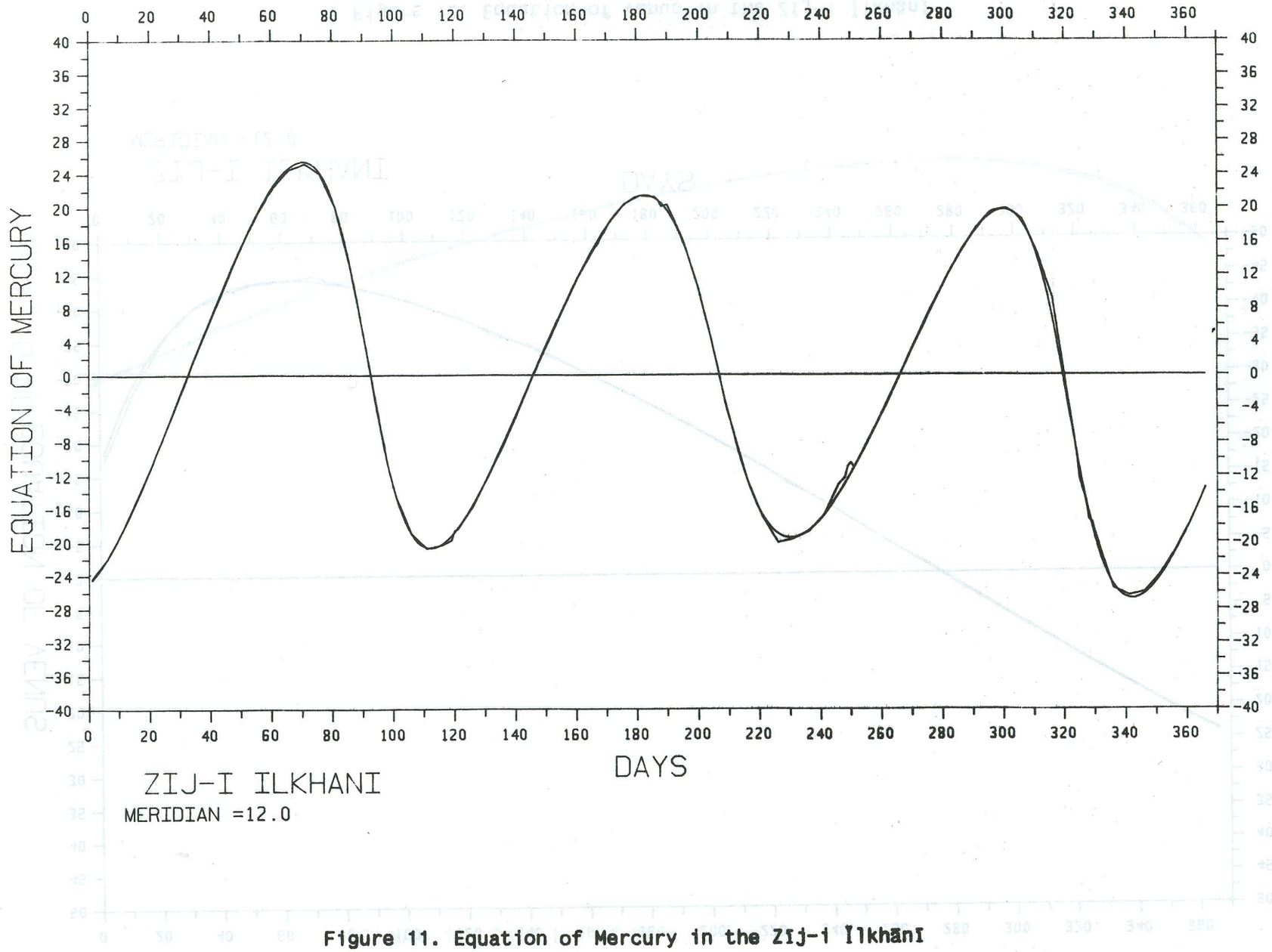

Figure 11. Equation of Mercury in the Zij-i Ilkhānī

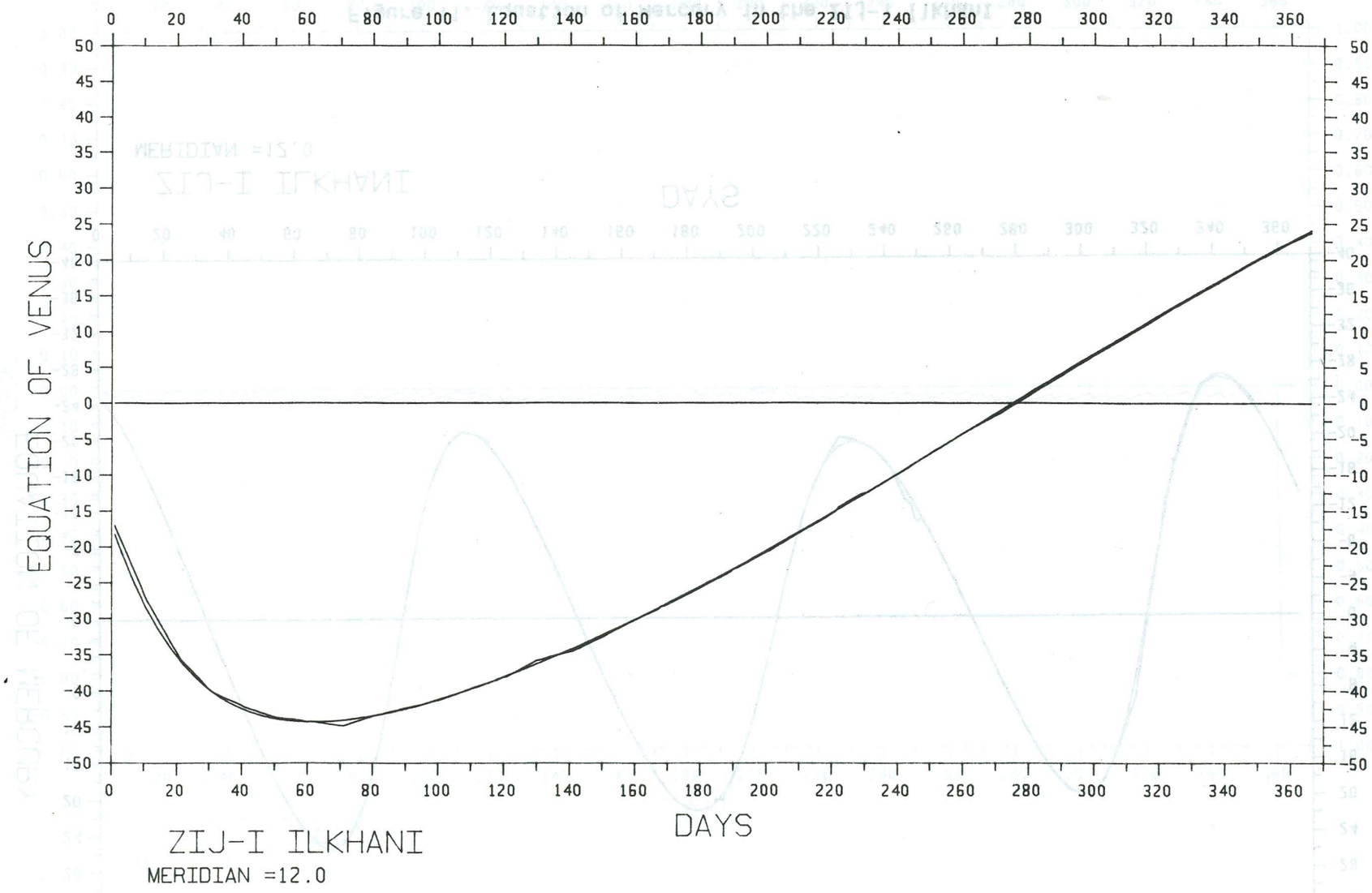

Figure 12. Equation of Venus in the Zīj-i Īlkhānī

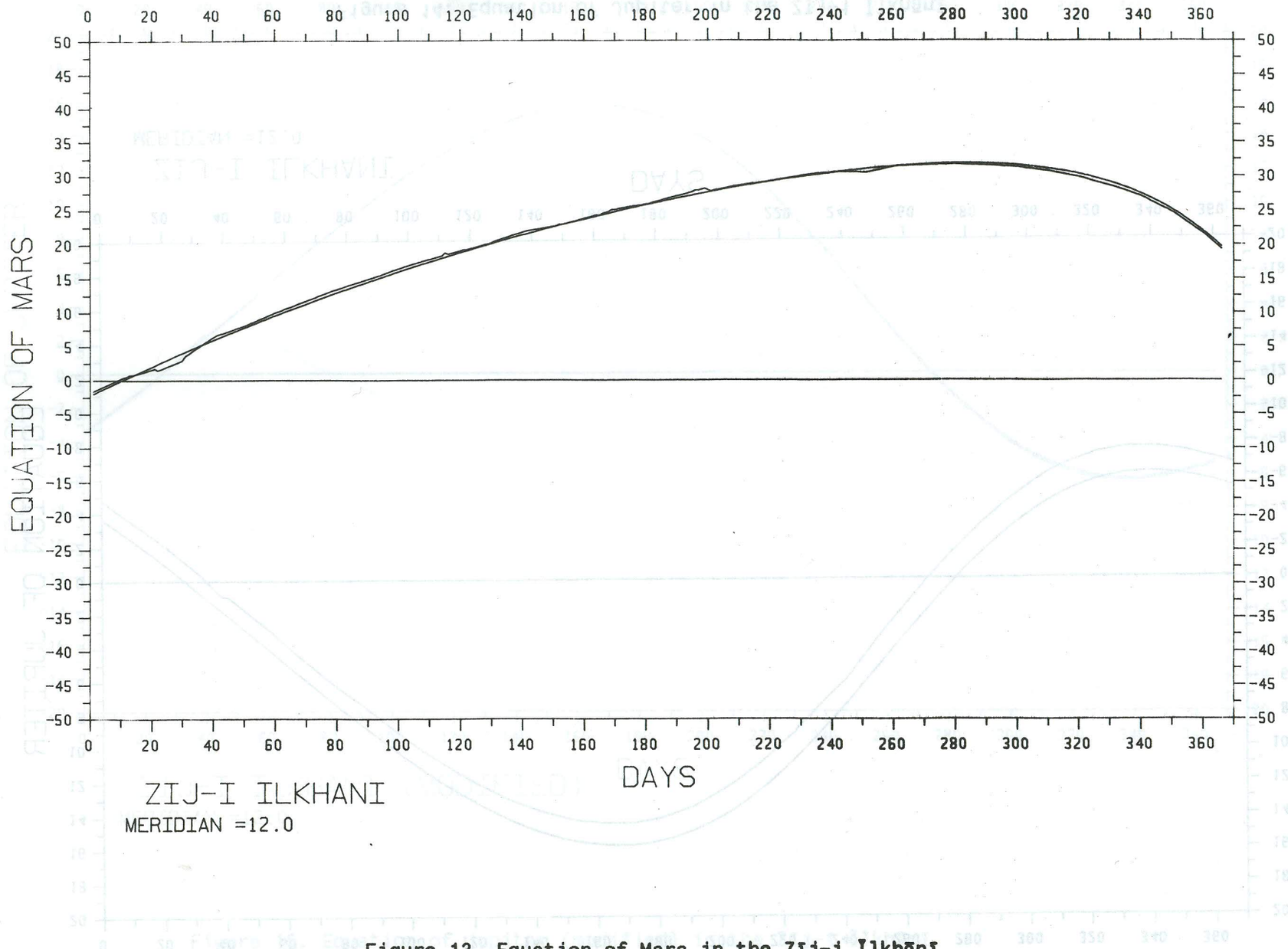

Figure 13. Equation of Mars in the Zij-i Ilkhānī

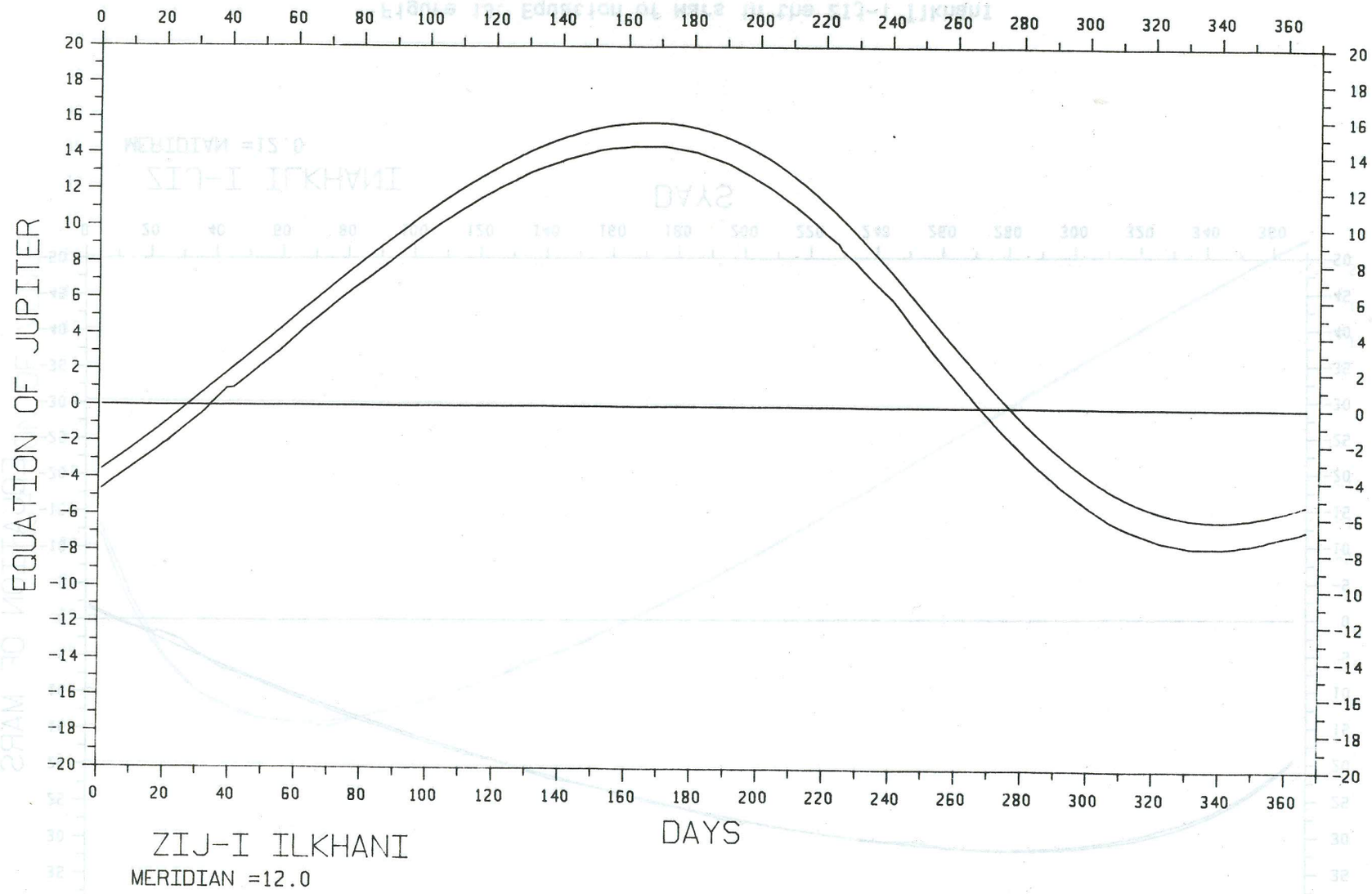

Figure 14. Equation of Jupiter in the Zīj-i Ilkhānī

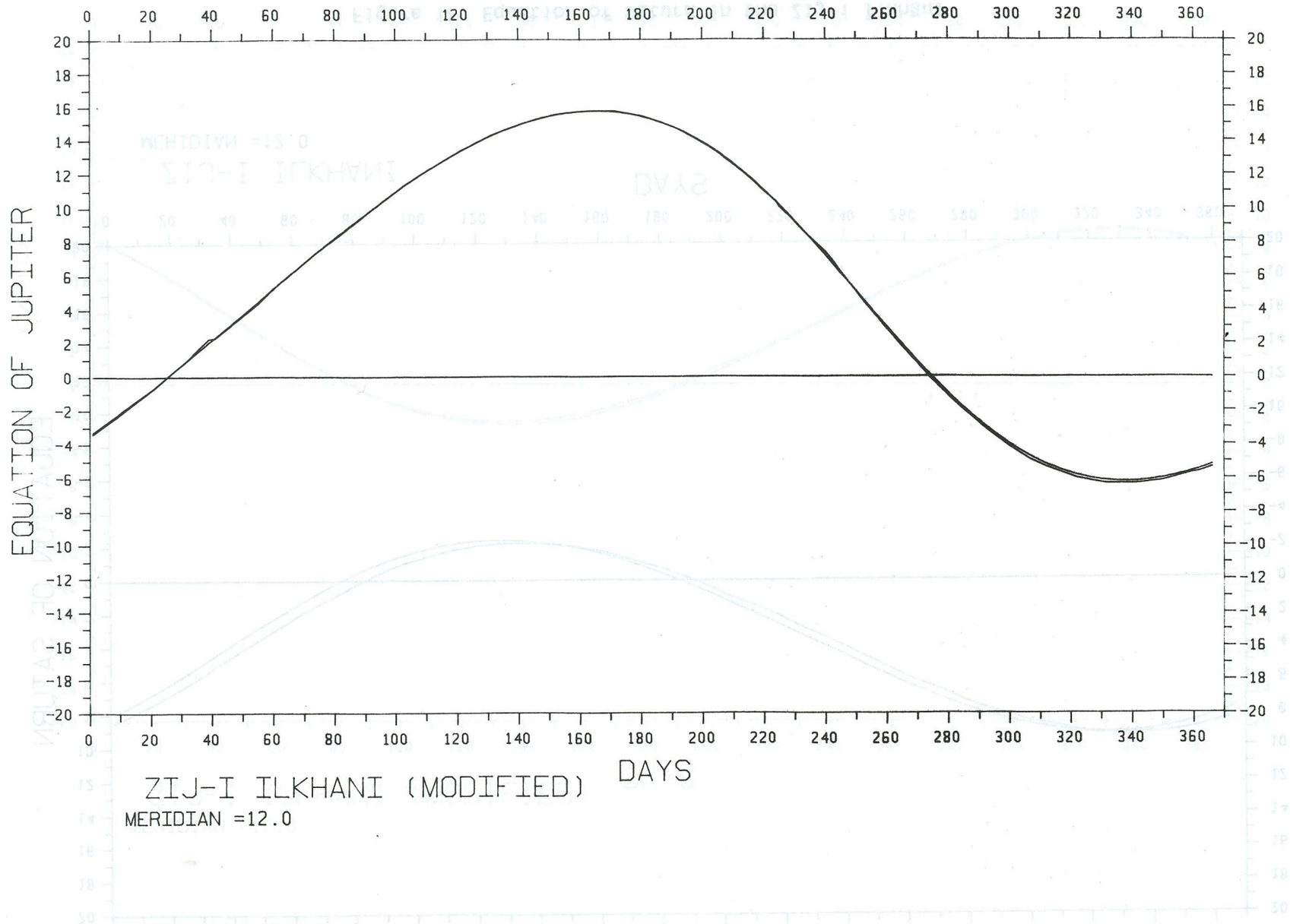

Figure 15. Equation of Jupiter (modified) in the Zīj-i Īlkhānī

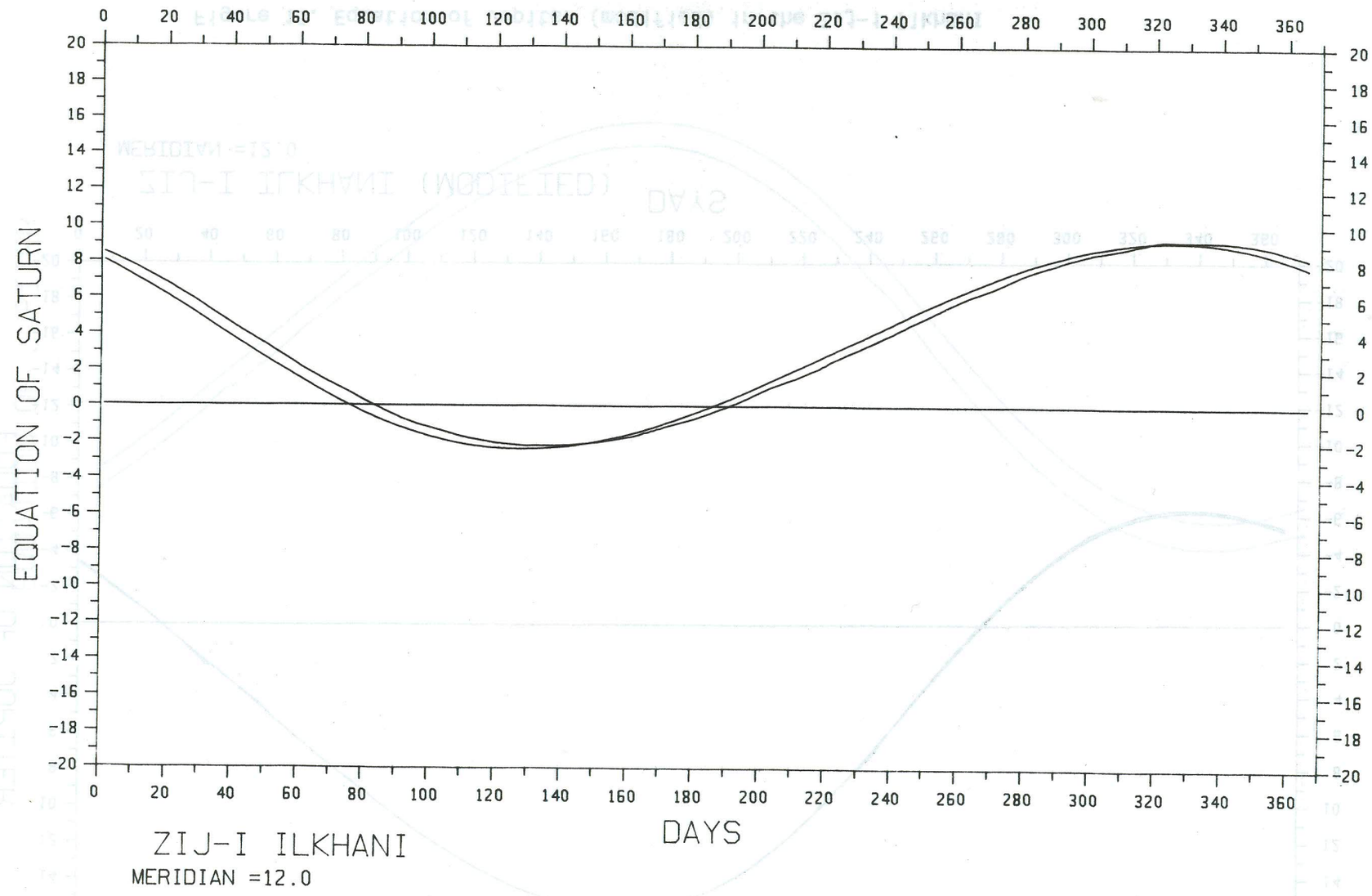

Figure 16. Equation of Saturn in the Zīj-i Īlkhānī

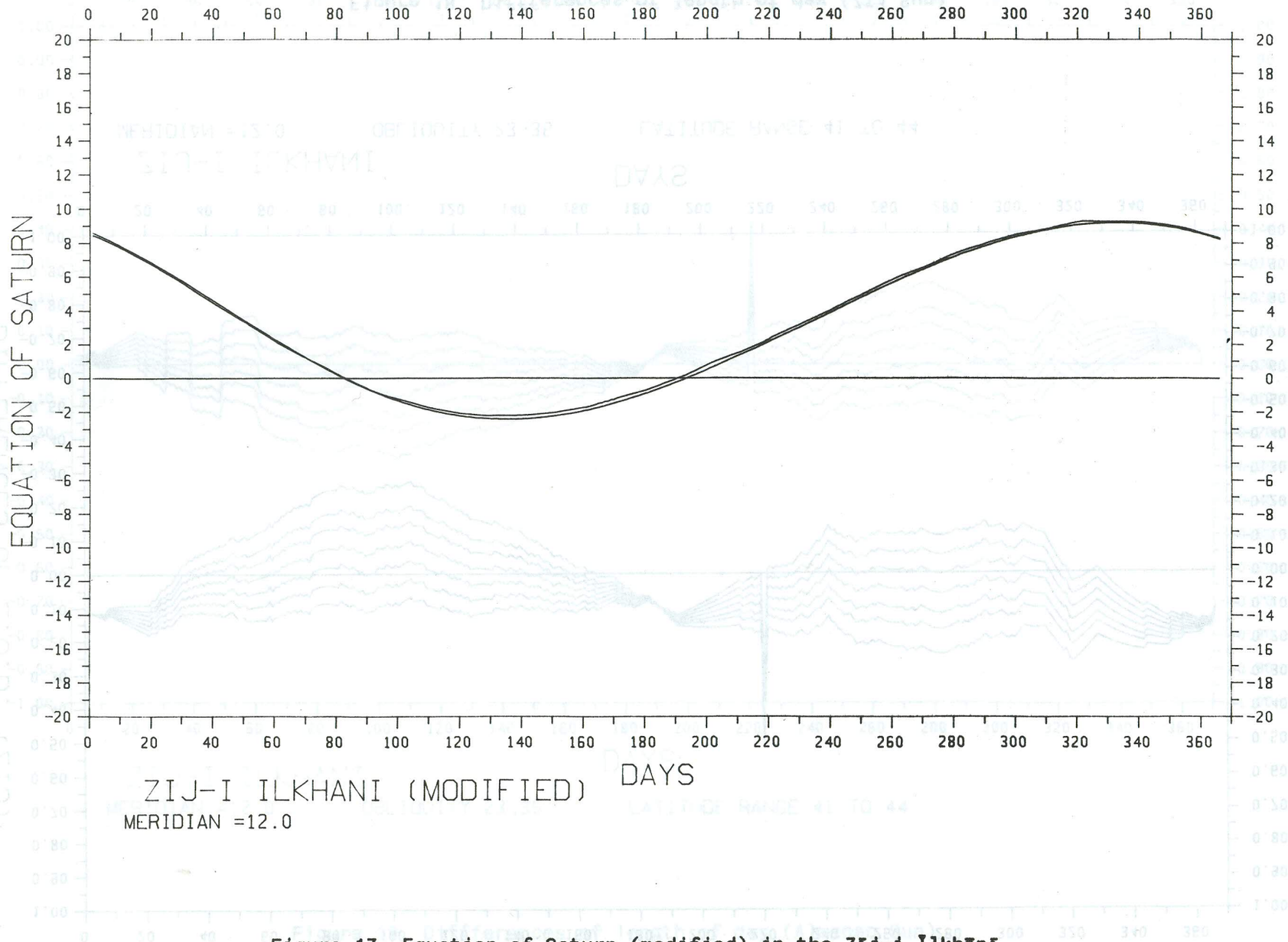

Figure 17. Equation of Saturn (modified) in the Zij-i Ilkhānī

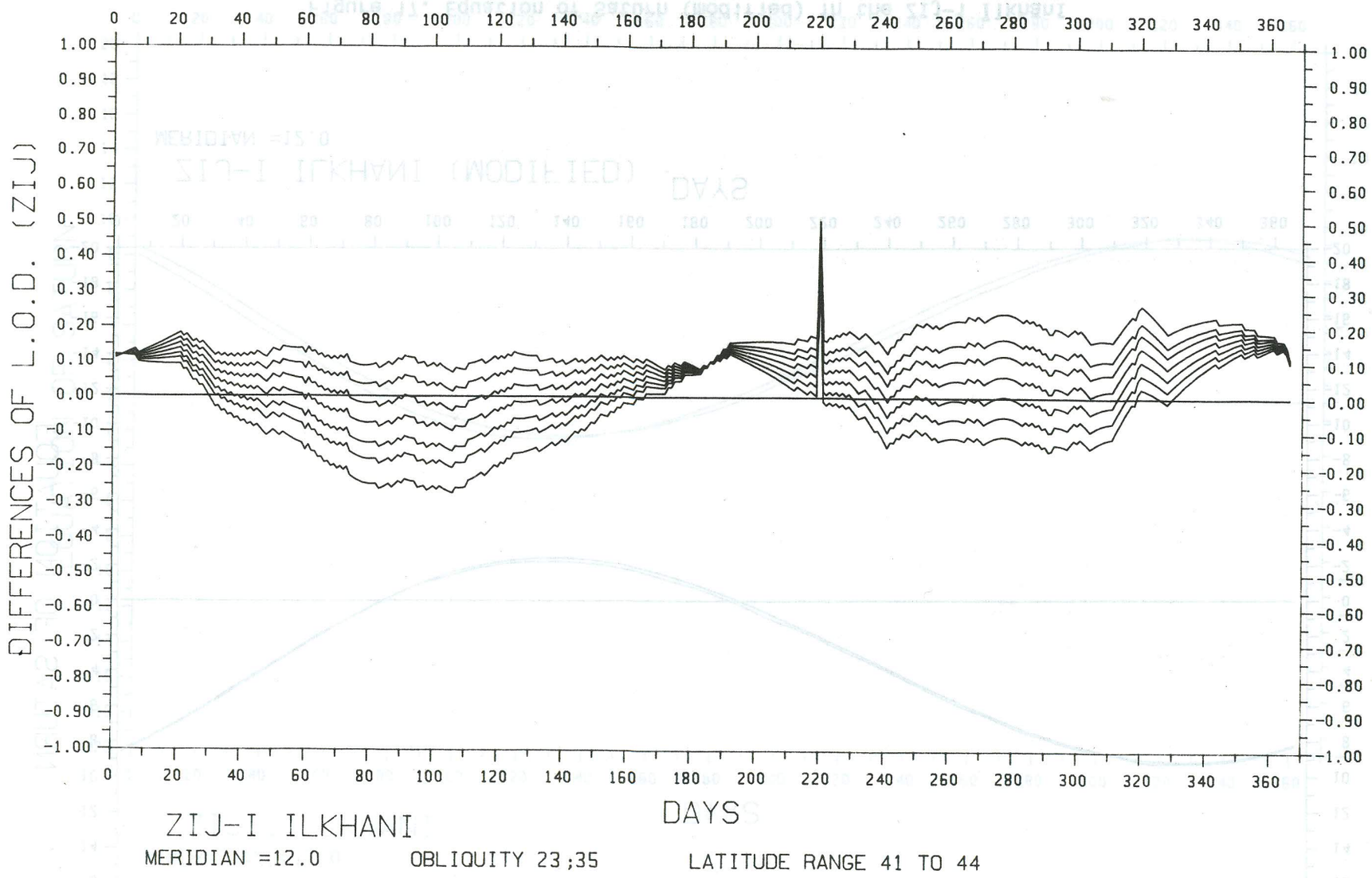

Figure 18. Diffferences of length of day (Zij Sun)

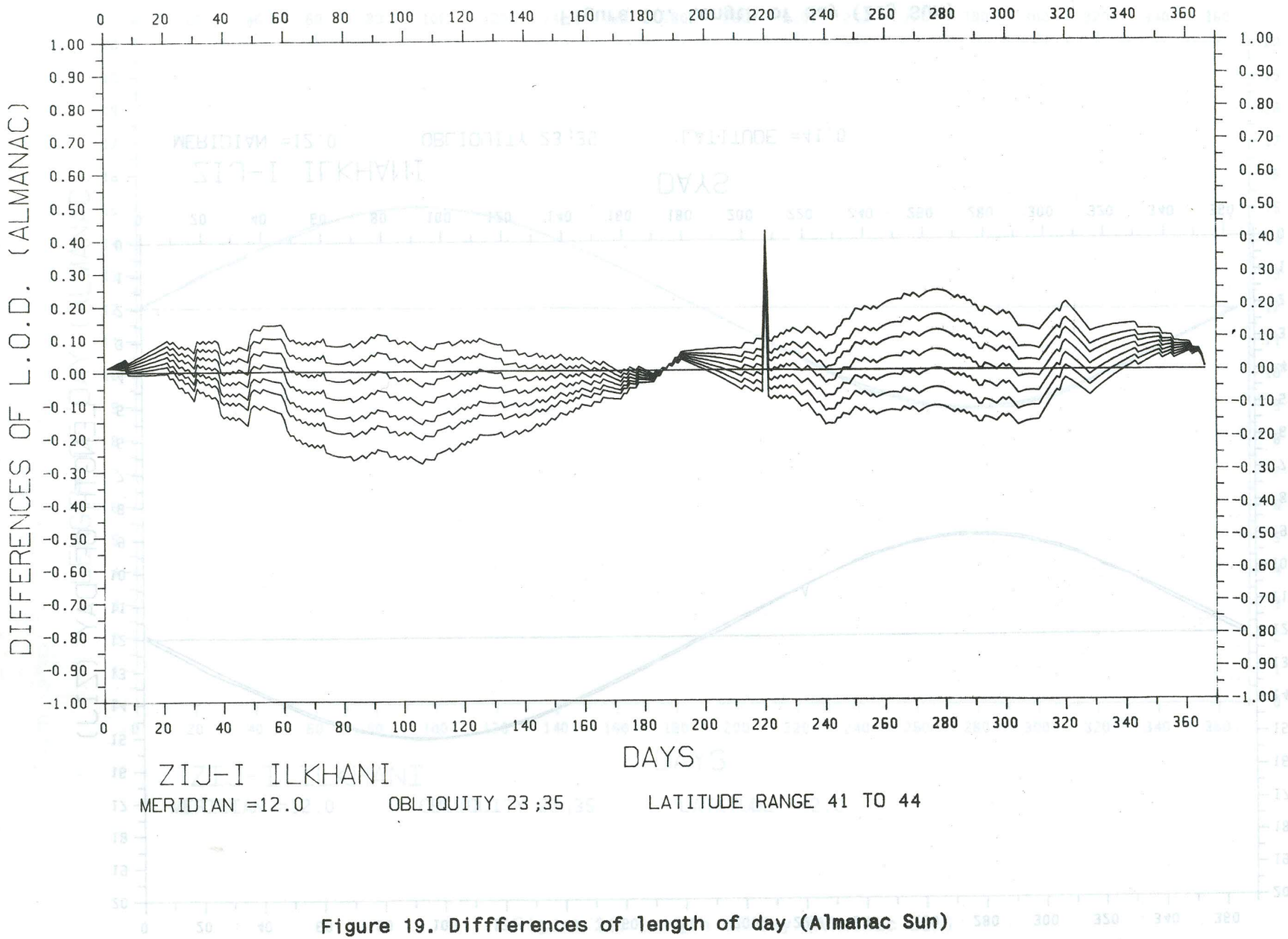

Figure 19. Diffferences of length of day (Almanac Sun)

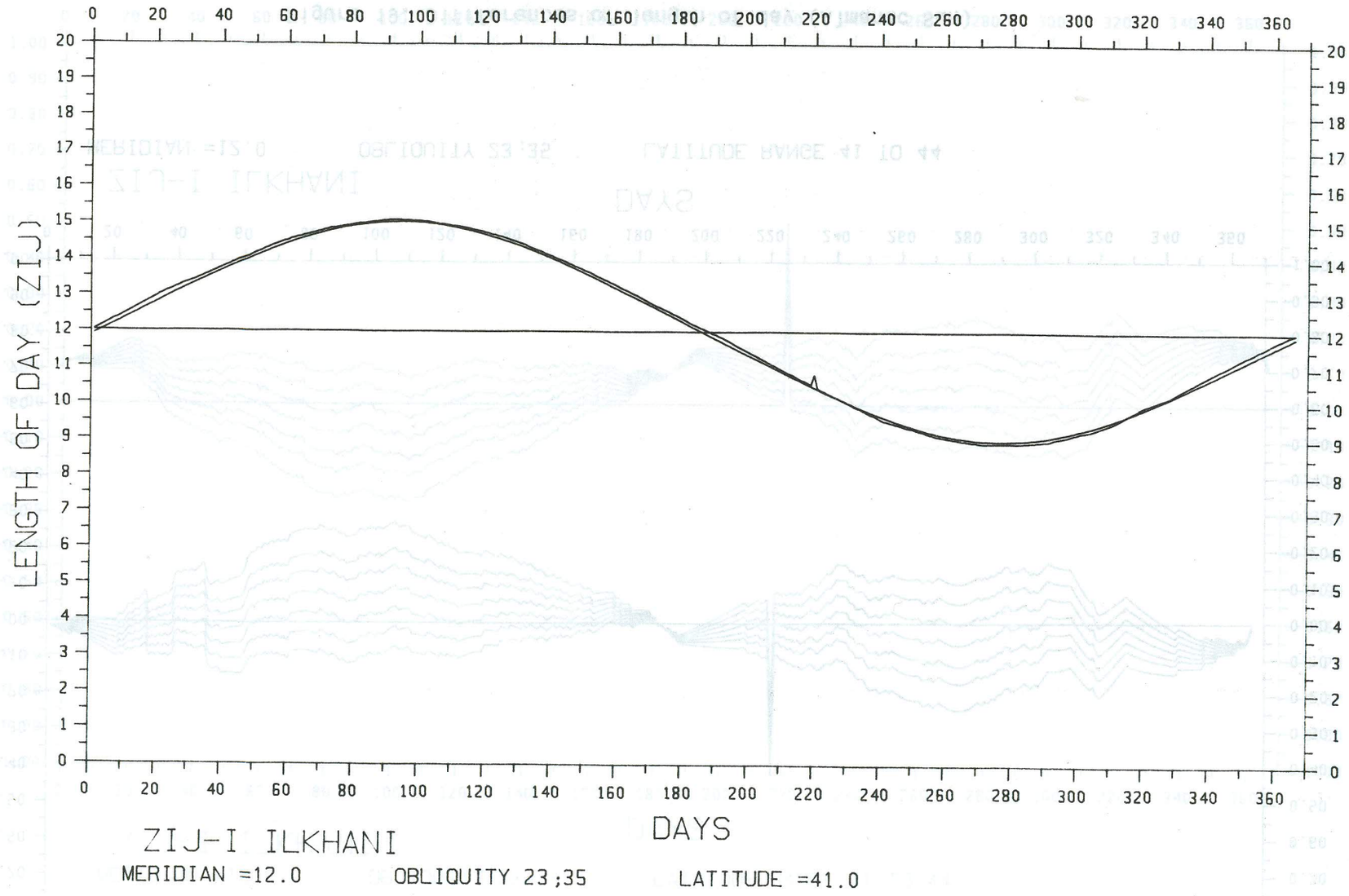

Figure 20. Length of day (Zīj Sun)

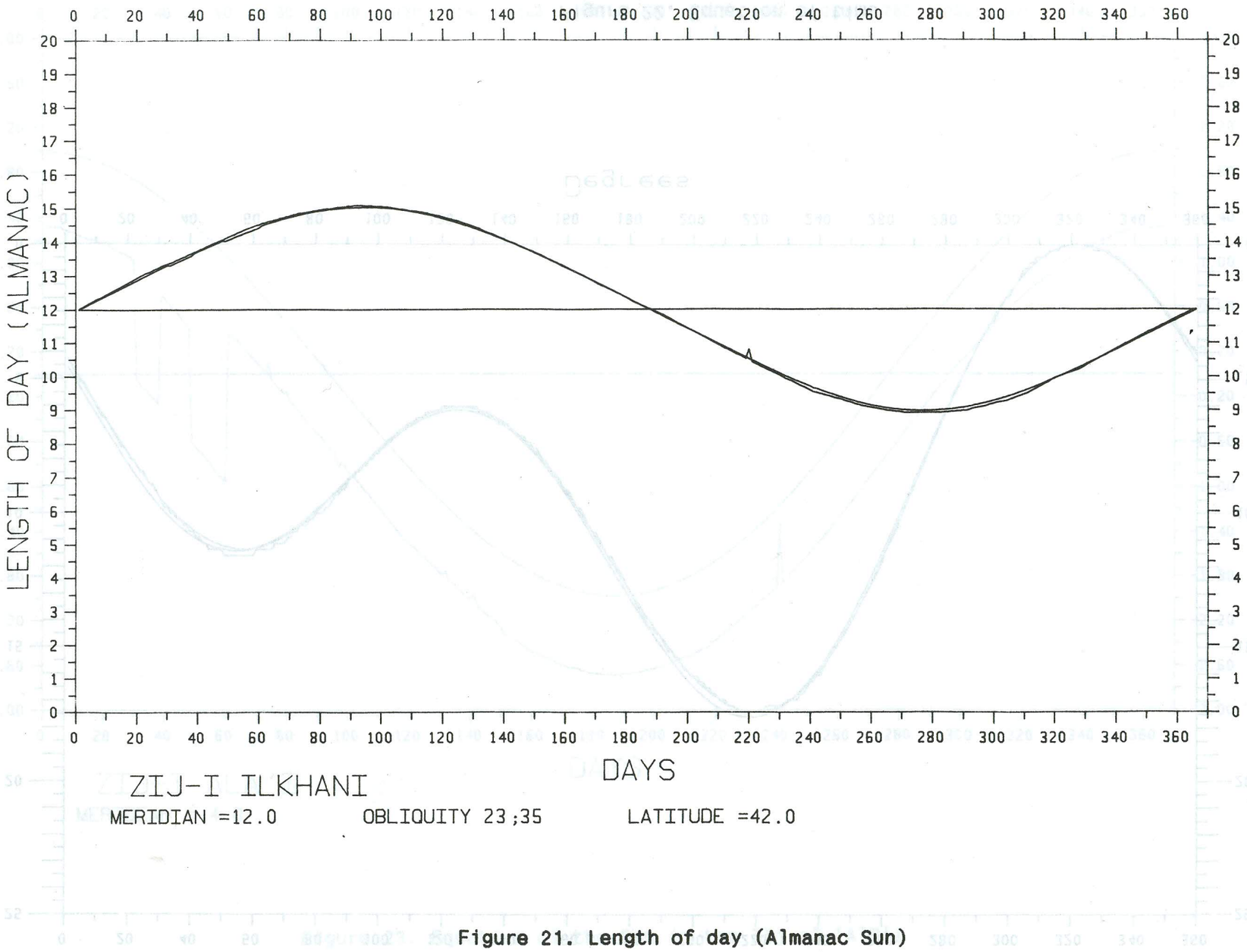

Figure 21. Length of day (Almanac Sun)

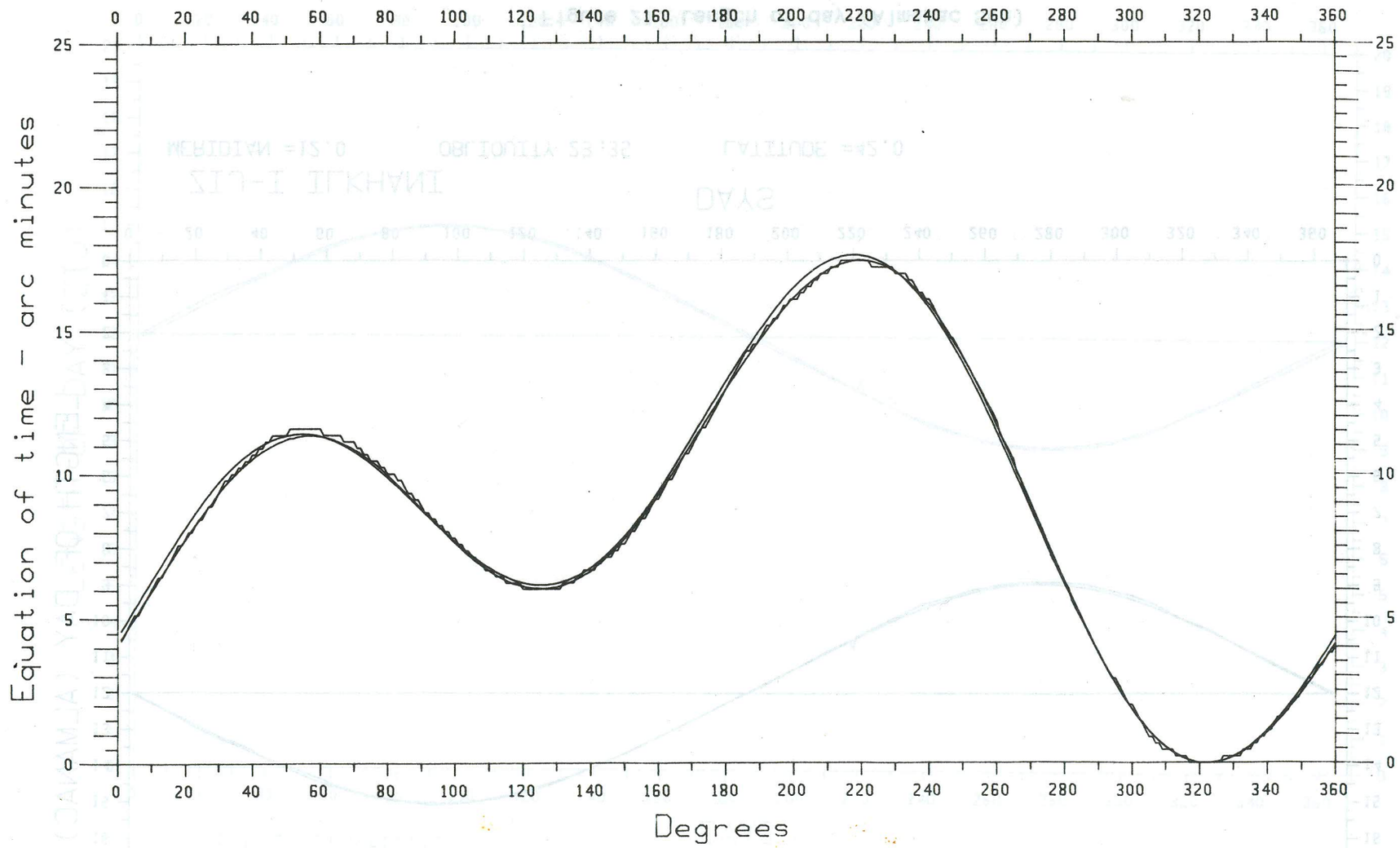

Figure 22. Equation of time

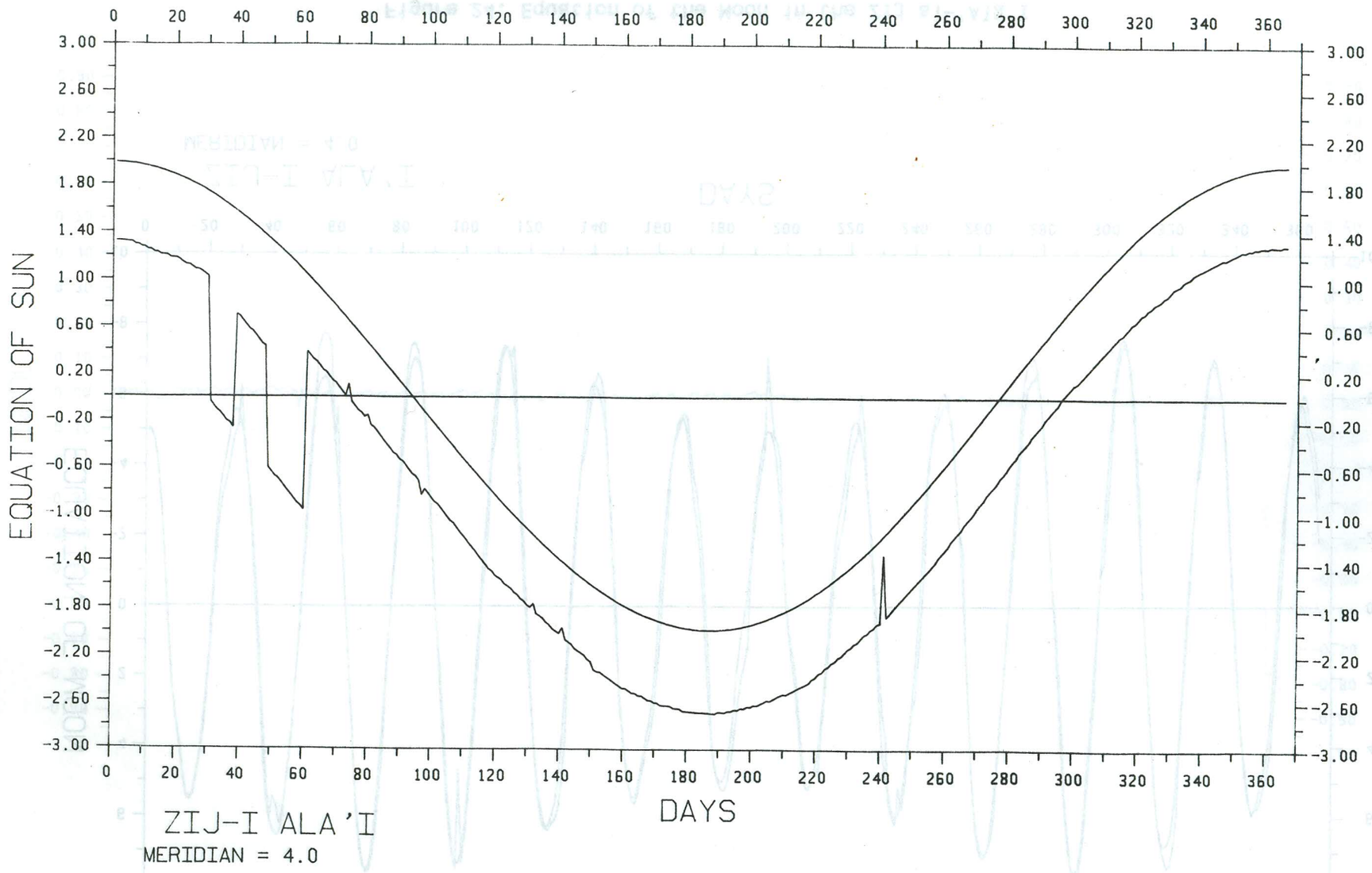

Figure 23. Equation of the Sun in the Zij al-'Alā'I

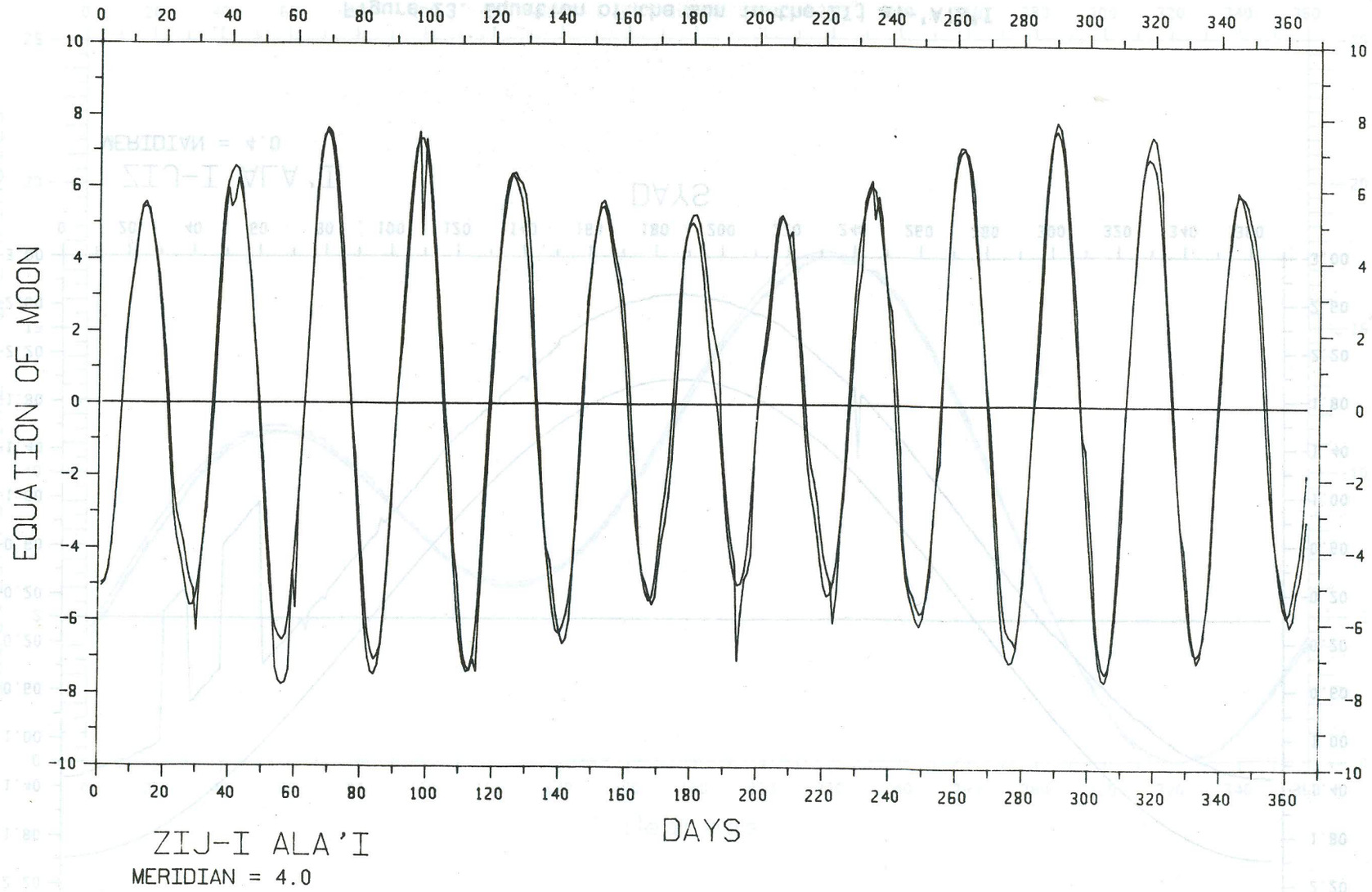

Figure 24. Equation of the Moon in the Zij al-'Alā'ī

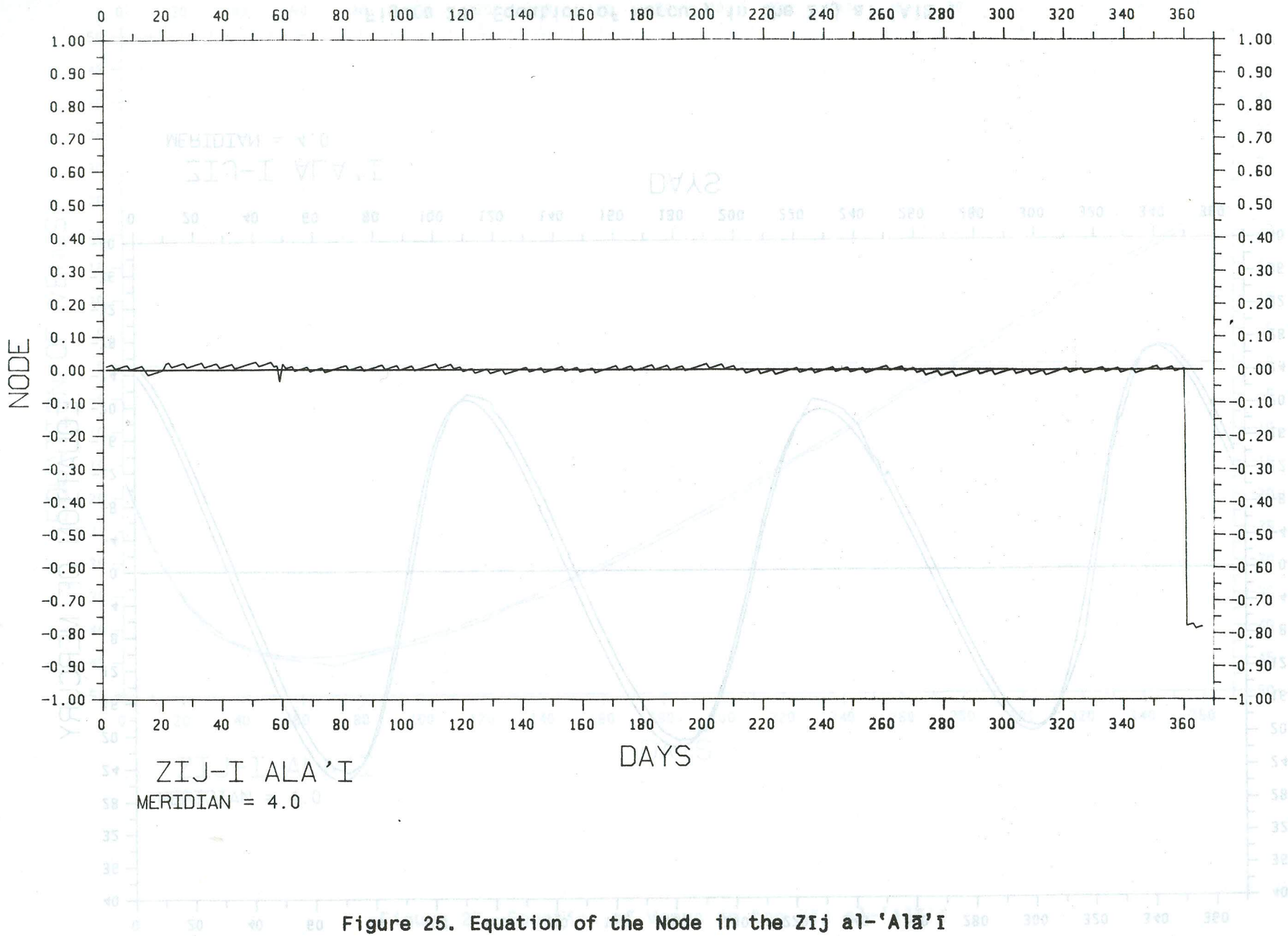

Figure 25. Equation of the Node in the Zij al-'Alā'I

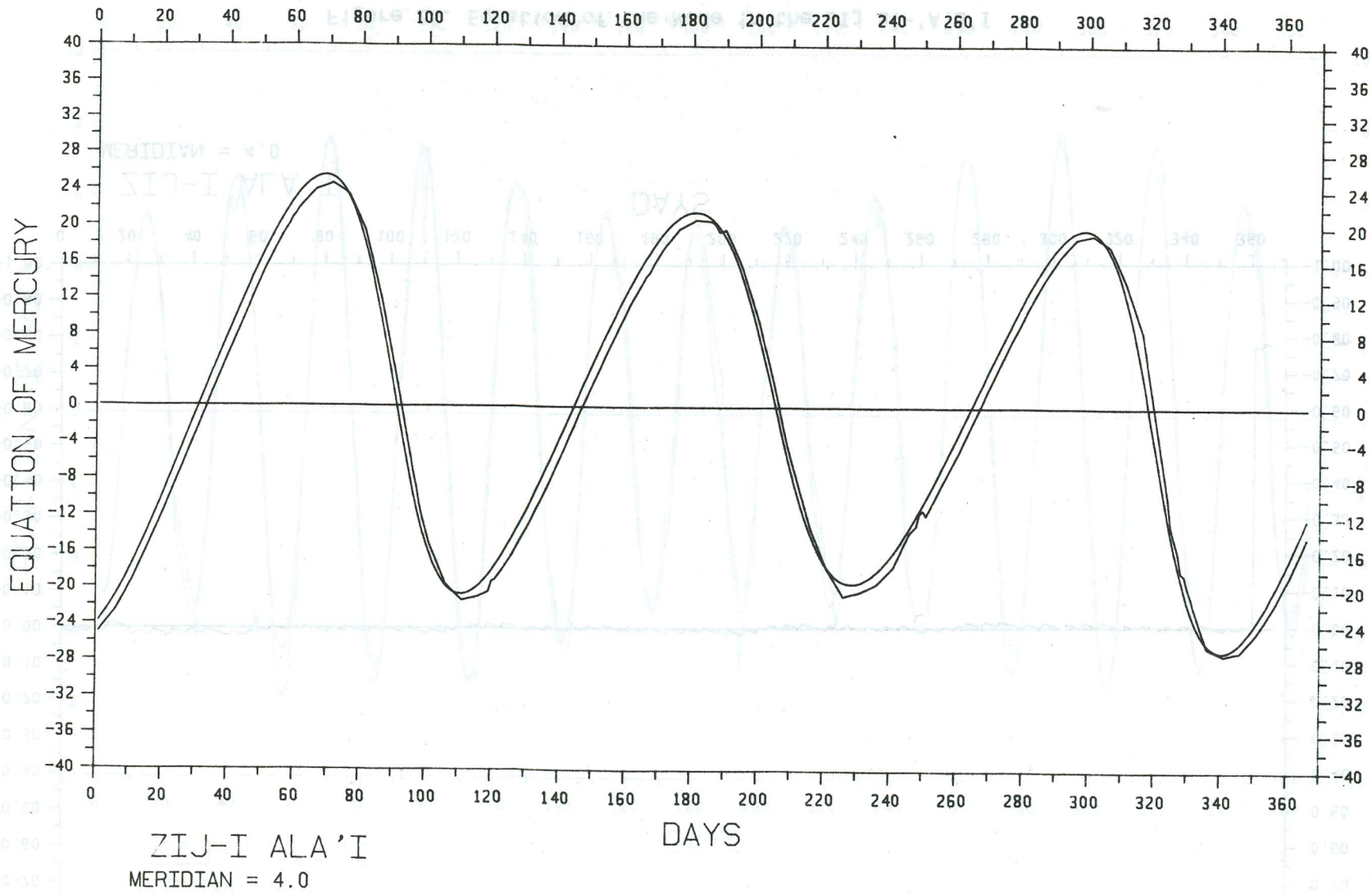

Figure 26. Equation of Mercury in the Zij al-'Alā'I

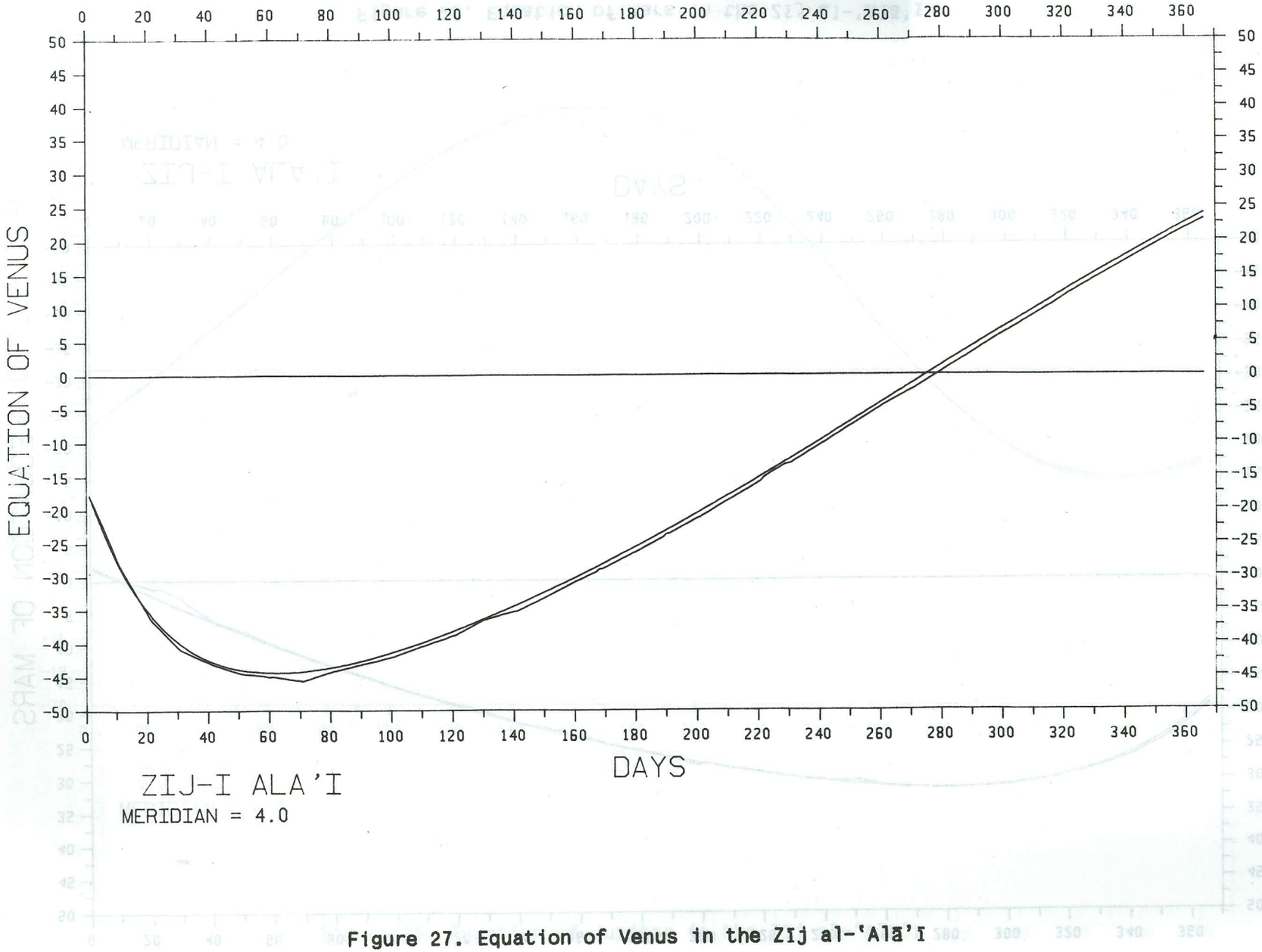

Figure 27. Equation of Venus in the Zij al-'Alā'I

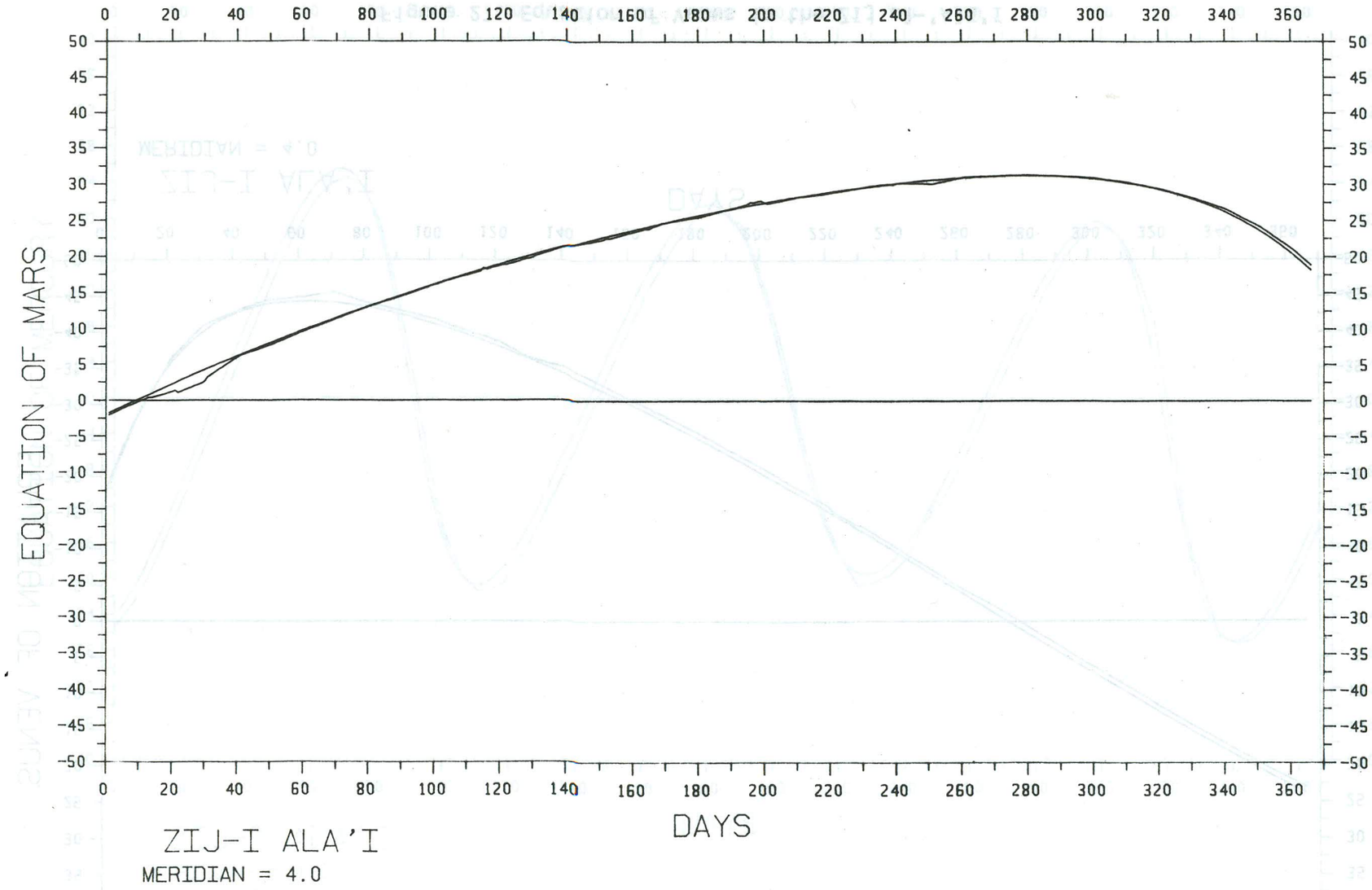

Figure 28. Equation of Mars in the Zīj al-'Alā'ī

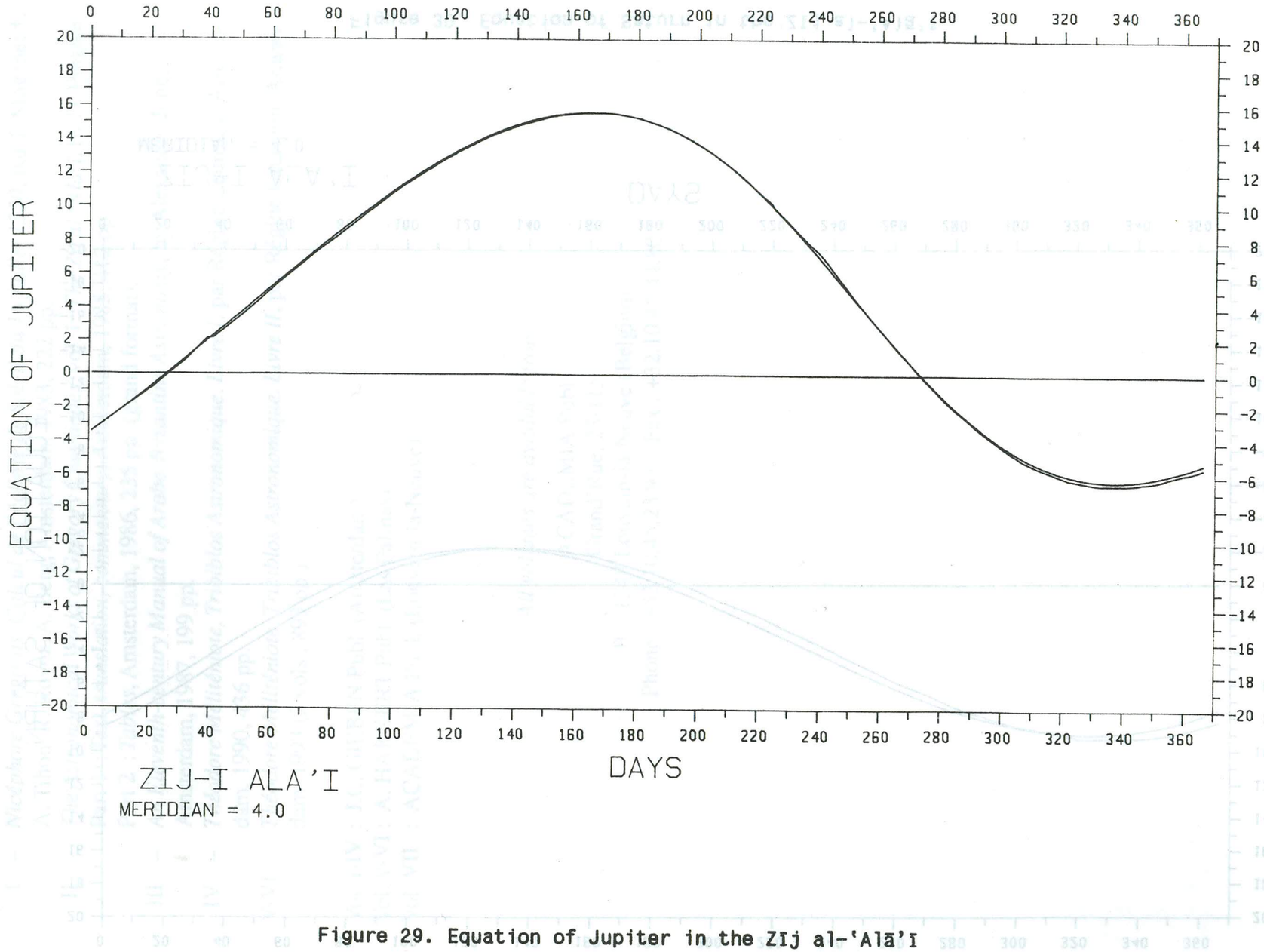

Figure 29. Equation of Jupiter in the Zīj al-'Alā'ī

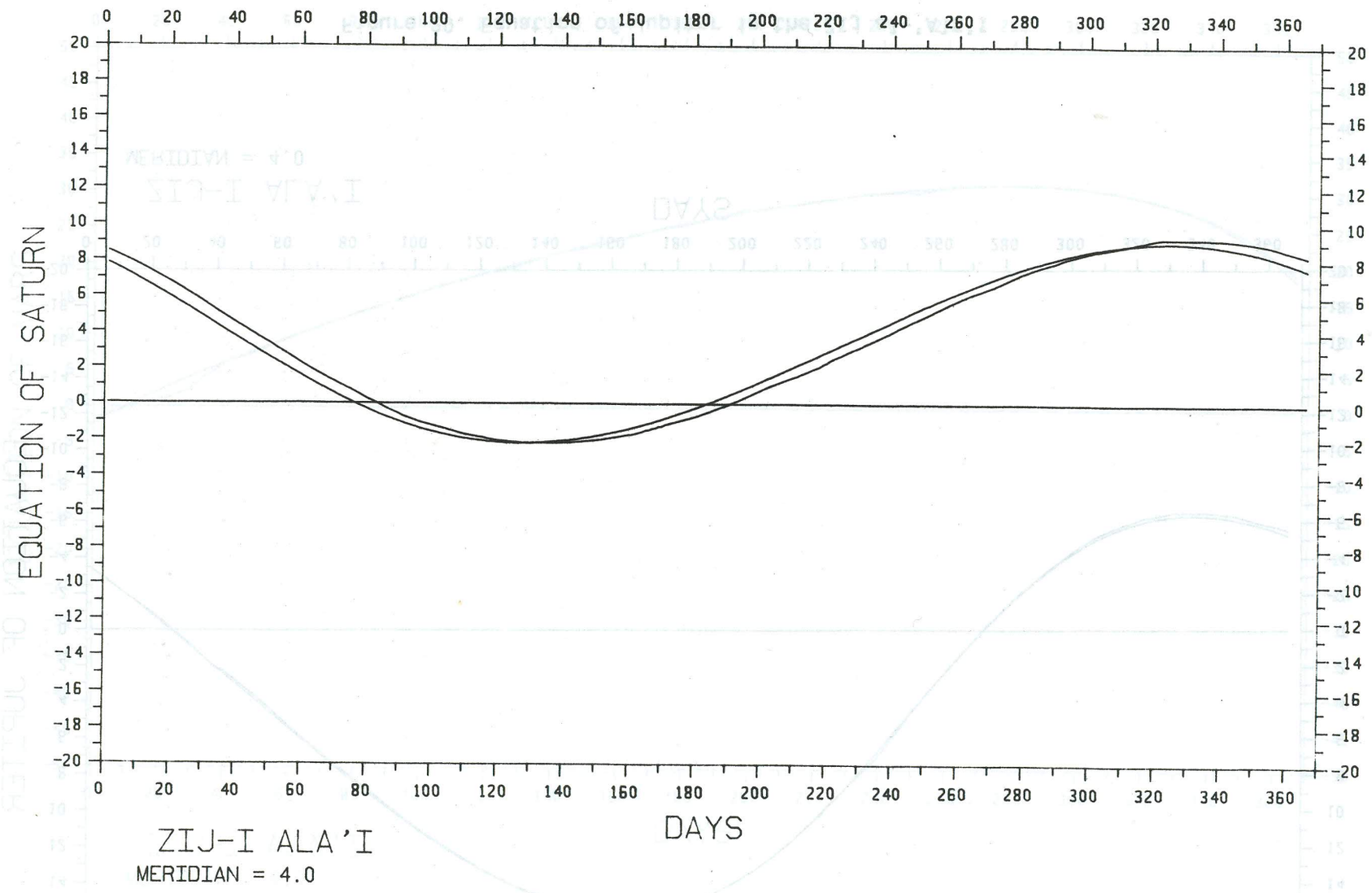

Figure 30. Equation of Saturn in the Zīj al-'Alā'ī

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