[illegible]

THE RELATIONSHIP OF THE
JEWISH (ARAMAIC) CALENDAR
TO THE
EGYPTIAN (PTOLEMAIC) CALENDAR
DURING THE PERSIAN PERIOD
AS SHOWN BY THE
ASSUAN PAPYRI

by

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THE ASSUAN PAPYRI

The Assuan papyri were discovered about the turn of the century and were first published by Sayce and Cowley in 1906. Assuan is located on the Nile just below the first cataract, some 120 miles south of the ancient capital of Thebes. At the time of the 5th century B. C. when these documents were written, the site was called Syene. At this place a colony of Jews had settled, evidently going down into Egypt either from Babylon or from Palestine during the period of the restoration. These documents cover a large portion of the 5th century B. C., being dated from the 15th year of Xerxes (471 B.C.) to the 14th year of Darius II (410 B.C.). Most of these papyri are perfectly legible and relate to conveyances of land and buildings, marriage contracts, and various legal processes between members of this Jewish colony. They are drawn with great care, being signed and properly witnessed and many of them still sealed at the time of discovery. At least eight of them are dated according to both the Hebrew and Egyptian calendars. Some of them are more specific than others giving special regnal years according to the calendar in which the da te is given.

In the various charts illustrating these papyri which are double dated, synchronisms have been carefully established between (1) the Jewish calendar (civil year) beginning with the 1st of the 7th month (Tisri) and containing 12 or 13 lunar months according to the 19-year cycle, (2) the Julian calendar which is the one used by all astronomers and chronologers working in pre-Christian dates, (3) the Egyptian or Ptolemaic Calendar, recording the years of the Nabonassar Era (Marked N. E. on the charts), beginning with the 1st of Thoth each year, (4) the Greek calendar based on the Olympiads, beginning each year a few days after the summer solstice, (5) the Persian calendar beginning with the 1st of Nisan in the spring -- a luni-solar calendar the same as the Jewish ritualistic year --, and (6) the Saros tablet.

This Saros tablet was found in the British Museum in 1884 and first published in the Proceedings of the Society of Biblical Archaeology, (See Strassmaier, Zeitschrift fur Assyriologie, Vol. VII, [1892], 199 ff. Vol. VIII [1893], 106 ff.), giving a list of kings ruling at the 18-year intervals of the saros period together with the year of their reigns corresponding to the first year of the period. The word "saros" refers to a Babylonian lunar cycle of 223 lunations or 6585.32 days. It is an eclipse cycle at the end of which the centers of the sun and moon return to such a relative position that the eclipses, both solar, and lunar, of the next 18 years can be predicted with astonishing accuracy. In each of these saros periods, there are about 29 lunar eclipses and 41 solar eclipses. Because of the slight difference in the relative position of the sun and moon, these returning eclipses in the following saros period appear in longitudes approximately one-third of the distance around the world west of the regions where they were first noted.

Insofar as the tablet goes, these periods begin with the 7th year of Nabonidus. All this tablet proports to do is to tell in what year of the reigning monarch the first year of the saros occurs. Thus:

	7th Year of Nabonidus								8th Year of Cyrus							9th Year of Darius		
Years of Reign	7	8	9	10	~	5	6	7	8	9	10	~	6	7	8	9	3	
Years of Saros	1	2	3	4	~	16	17	18	1	2	3	~	16	17	18	1	2	etc.

←——— 18 yrs. ———→←——— 18 yrs. ———→←———

The number on the tablet just before the king's name is year 1 of the 18-year saros period. Thus year 7 of the reign of Nabonidus corresponds with year 1 of this saros period or 18-year cycle. The year 8 of the reign of Cyrus then corresponds with year 1 of the next saros period. The following table is a translation of the first portion of this saros tablet covering the years from Nabonidus through the 36th year of Artaxerxes. That which is enclosed in parentheses has been restored by Strassmaier, for that portion of the tablet was broken. From other sources, however, it is easy to complete accurately the missing portions.

Portion of the Saros 18 year Cycle Tablet Covering the Fifth Century[1]

7	Nabonidus	(18)
(8)	Cyrus	18
9	Darius	18
27	Darius	18
9	Xerxes	18
6	Artaxerxes	18
(24	Artaxerx)es	(18)
(1	Darius II	18)
19	Darius II	18
18	Artaxerxes II	18
36	Artaxerxes II	18

This Saros table, therefore, becomes an excellent means of checking the reigns of the Persian period from an astronomical viewpoint. For all of these Persian kings, contract tablets have been found dated in a year called the "accession year", which is evidently a year distinct from the first year of the king's reign. For example, the latest tablet for Nabonidus, is dated in the 17th year and the 9th month.[2] This harmonizes with the length of reign given Nabonidus by Ptolemy in his Canon. If now the "accession year" of Cyrus was a year different from either the 17th year of Nabonidus or the 1st year of Cyrus' reign, the 18-year saros period would reach only to the 7th year of Cyrus and not the 8th as required by the Saros tablet, thus:

	Nabonidus											Cyrus								
Year of Reign	7	8	9	10	11	12	13	14	15	16	17	acc.	1	2	3	4	5	6	7	8
Year of Saros	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1	2

However, if the "death year" of Nabonidus and the "accession year" of Cyrus are counted as one and the same year, the first year of Cyrus' reign beginning with the new calendar year, then the record of the saros tablet becomes exact, thus:

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[1] Arno Poebel, (Republished and discussed) A J S L, LVI (1939), 121-146.

[2] Strassmaier, Zeitschrift fur Assyriologie, Vol. IV, Nabonidus Tablet No. 1055.

	Nabonidus											Cyrus								
Year of Reign	7	8	9	10	11	12	13	14	15	16	17A	1	2	3	4	5	6	7	8	9
Year of Saros	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1	2

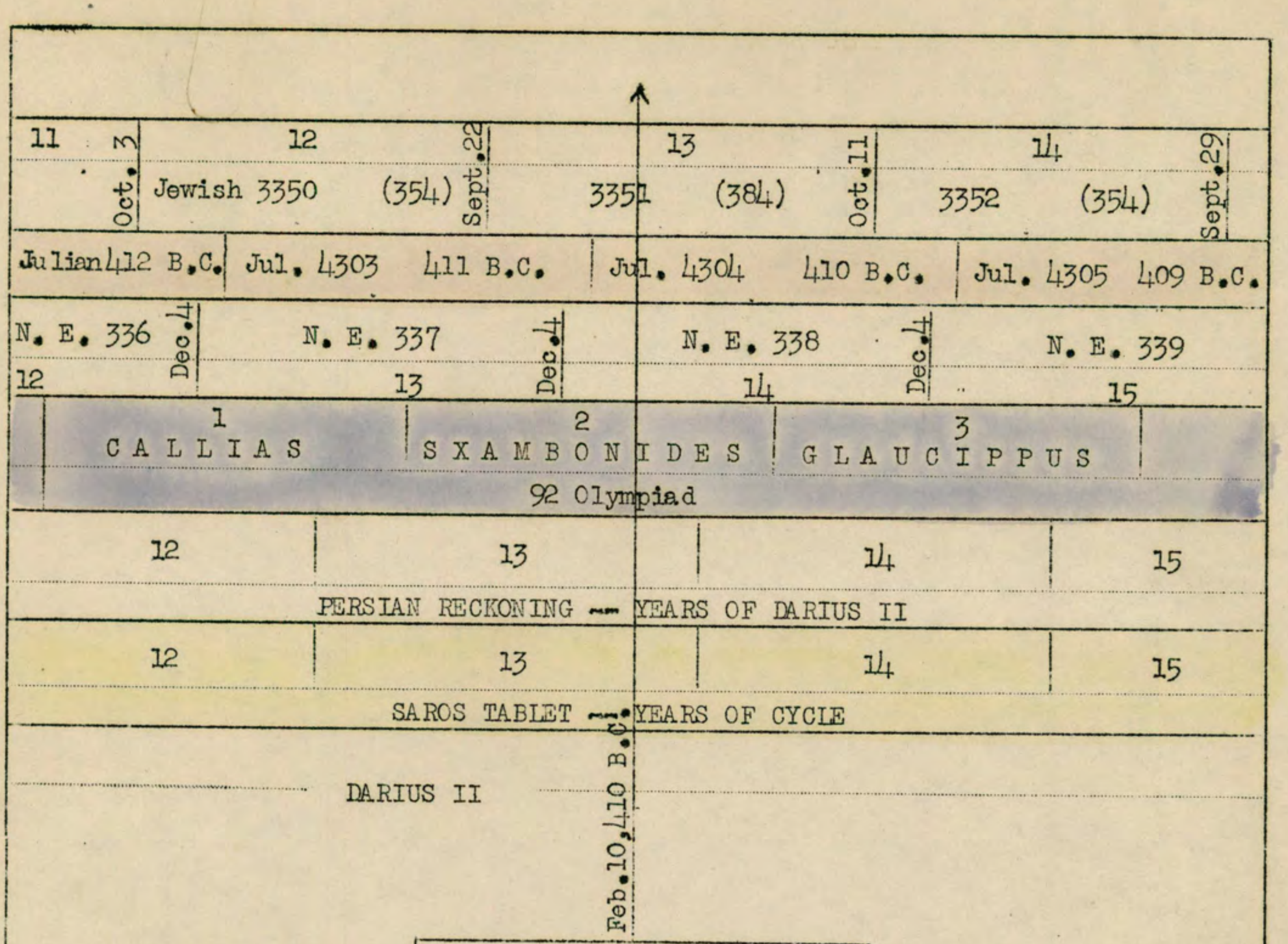
This may be checked with all the kings named on the list and found to work in exactly the same manner, thus definitely proving that in the Babylonian-Persian chronology, the death year of the king is counted as the last year of his reign and is also counted as the accession year of the following king, thus:

Nabonidus		Cyrus
16	17 Death Year & Access. Year	1

The charts as shown on pages 6 - 13 of this paper are only excerpts from a long chart tracing the calendars in their synchronisms year by year from the days of Nabonidus through the year 400 B. C. They explain themselves.

COMPARATIVE TRANSLATIONS OF THE ASSUAN PAPYRI

Papyrus	A. E. Cowley				E. B. Knobel				J. K. Fotheringham			
	Jew. Date	Eg. Date	Reign	Yr.	Jew. Date	Eg. Date	Reign	Yr.	Jew. Date	Eg. Date	Reign	Yr.
A	18 Elul	28 Pachons	15 Xerxes	471	18 Elul	28 Pachons	15th of Xerxes	471	17, (18) Elul	27, (28) Pachons	14, (15) Xerxes	471
B	18 Chisleu	7 Thoth	21; Begin. of Artax.	465	18 Chisleu	6 Thoth	1st of Artax.	464	18 Chisleu	6, (7)(8)? Thoth	20, (21) Xerxes	464
D	21 Chisleu	1 Mesore	6th of Artax.	459	Cannot be harmonized				21 Chisleu	1 Mesore	6, (5) Artax.	460
E	3 Chisleu	10 Mesore	19th of Artax.	447	3 Chisleu	10 Mesore	19th of Artax.	446	3 Chisleu	10 Mesore	19th of Artax.	446
F	14 Ab	19 Pachons	25th of Artax.	441	14 Ab	19 Pachons	25th of Artax.	440	13, (14) Ab	19 Pachons	25th of Artax.	440
G	25 Tishri	6 Epiphi	- - - - -	441		Suggests	Year	446	26 Tishri	6 Epiphi	- - - - -	446
H	Elul	Payni	4th of Darius	420		Suggests	Year	420		Suggests	Year	420
J	3 Chisleu Yr. 8	12 Thoth Yr. 9	8, 9th of Darius	416	3 Chisleu	12 Thoth	8th of Darius	416	3 Chisleu	11, (12) Thoth	7, (8)(9) Darius	416
K	24 Shebat Yr. 13	9 Athyr Yr. 14	13, 14 of Darius	410	24 Shebat	9 Athyr	4th of Darius	410	23, (24) Shebat	8, (9) Athyr	13, (14) Darius	410
	A. E. Cowley Aramaic Papyri of the 5th Century, B. C. Oxford Clarendon Press (1923)				E. B. Knobel "Suggested Explanation of the Ancient Jewish Calendar Dates on the Aramaic Papyri." Monthly Notices R.A.S. LXVIII, (1908) London R.A.S. (1908) pp. 334 - 345.				J. K. Fotheringham "Calendar Dates in the Aramaic Papyri from Assuan." Monthly Notices R.A.S., LXIX (1908) London, R.A.S., (1909) pp. 12 - 20.			



"Papyrus K"
Dated 13th yr. Darius
24th of Shebat
= 14th yr. Darius
9th of Athyr
Sayce & Cowley: - Aramaic Papyri Discovered at Assuan

6	Sept.27	7 Jewish 3345 (384)	Oct.16	8 3346 (355)	Oct.6	9 3347 (354)

Julian 417 B.C.	Jul. 4298 416 B.C.	Jul. 4299 415 B.C.	Jul. 4300 414

N. E. 331 7	Dec.5	N. E. 332 8	Dec.5	N. E. 333 9	Dec.5	N. E. 334 10

4 EUPHEMUS	ARIMNESTUS 1	2 CARIUS
91 Olympiad		92 Olympiad

7	8	9	10

PERSIAN RECKONING -- YEARS OF DARIUS II

7	8	9	10

SAROS TABLET -- YEARS OF CYCLE

Dec.16,416 B.C.

DARIUS II

"Papyrus J"
Dated: 8th year Darius
3d Chisleu
== 9th year Darius
12th Thoth
Sayce & Cowley: -- Aramaic
Papyri Discovered at Assuan

UNGNAD NO. 30 PAPYRUS

This papyrus[3], coming from Elephantine close to Assuan, is also double dated, from the same period of Persian history. It is dated "In the 7th of Chisleu which is the 4th day of the month Thoth in the 9th year of Artaxerxes." This contract, as is shown by the date, comes from the same season of the year as both "J" and "K" yet it gives the year in terms of the Egyptian calendar only, plainly taking it for granted that the parties concerned will know that at this time of the year the "9th year of Artaxerxes" in terms of the Egyptian calendar was the "8th year of Artaxerxes" according to the Jewish calendar, it only being necessary to state the day of the month according to each system, to make the contract plain and legal.

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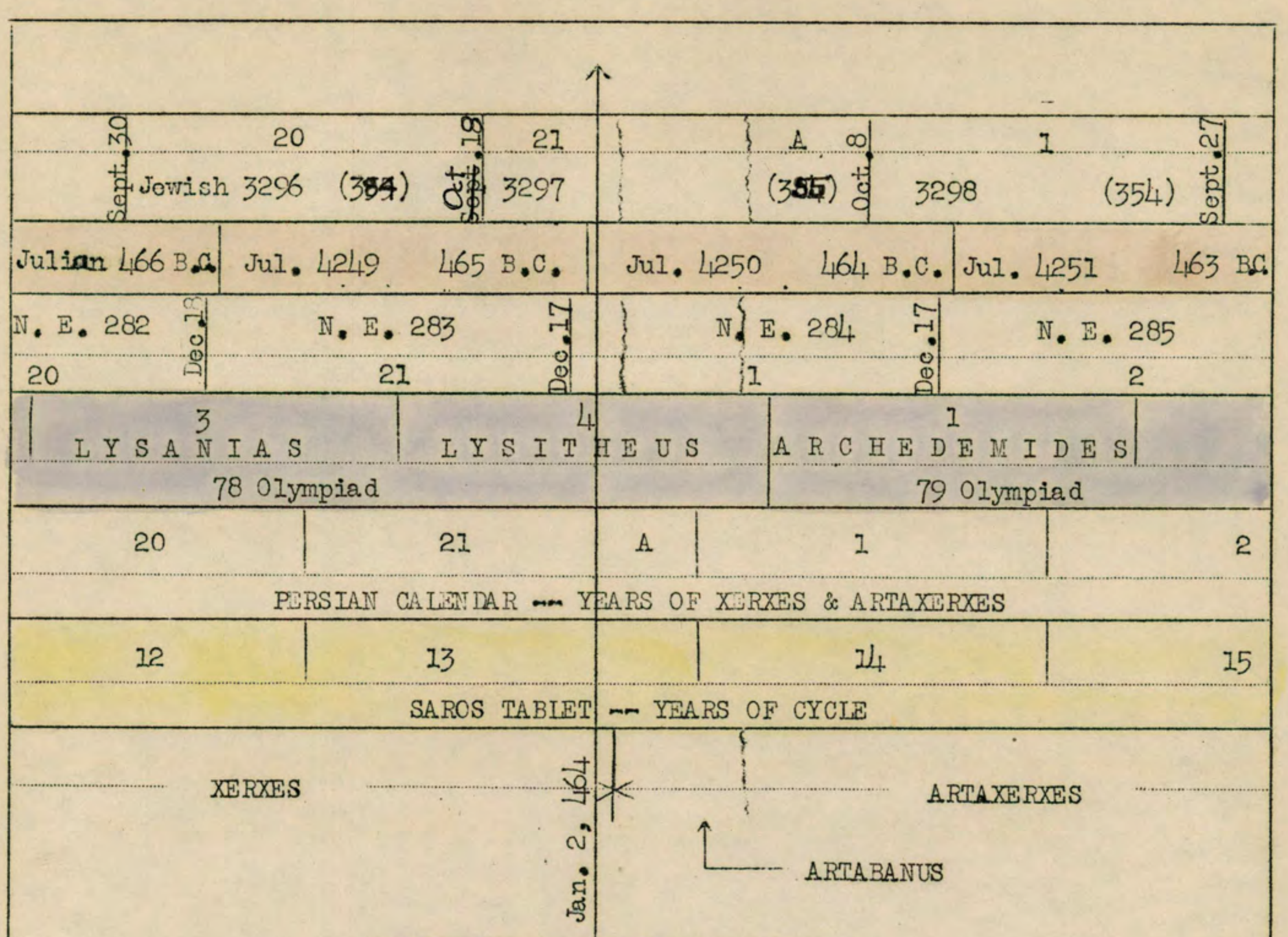
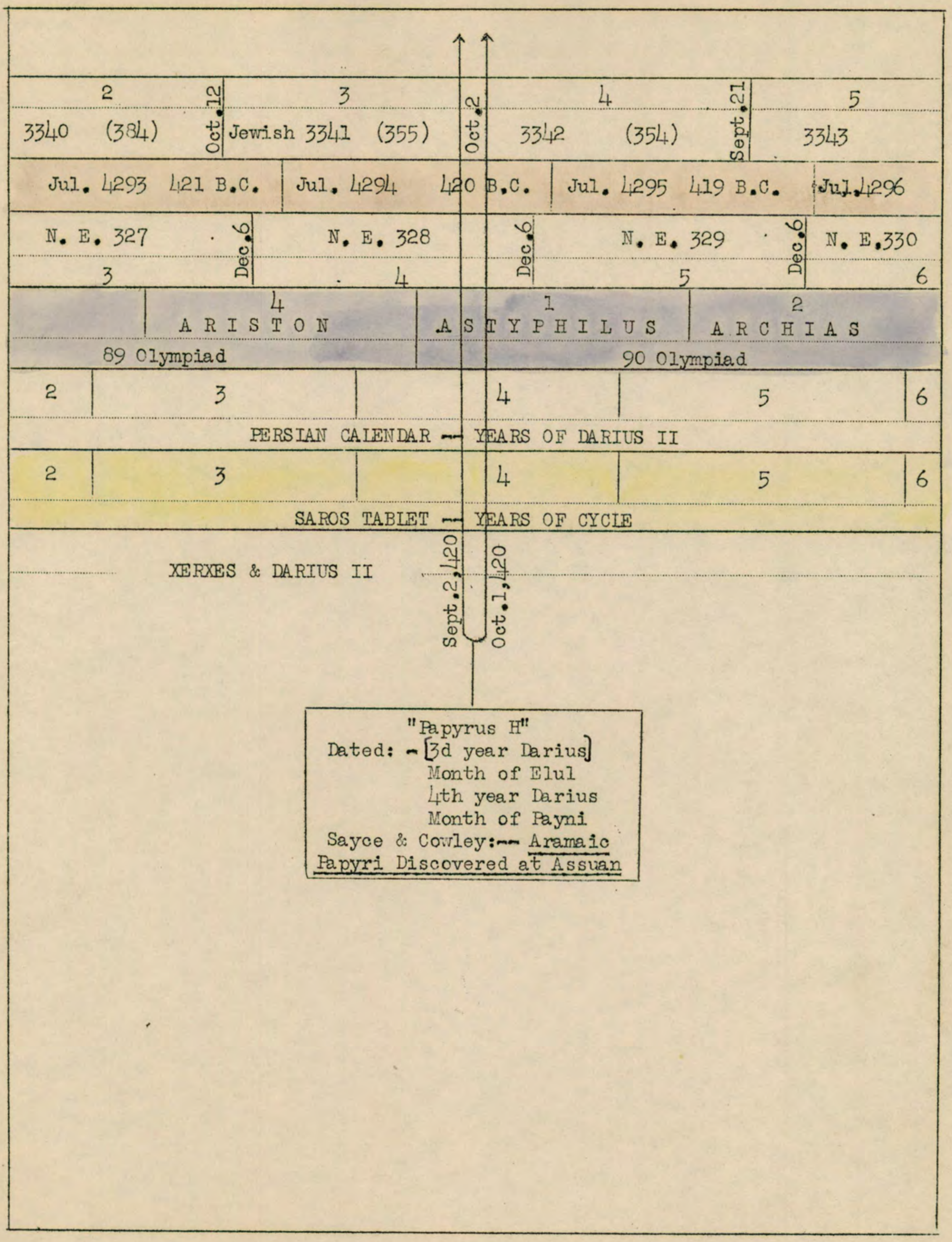
[3] Arthur Ungnad, Aramaische Papyrus and Elephantine, Leipzig: J. C. Hinrichs, (1911), p. 46.



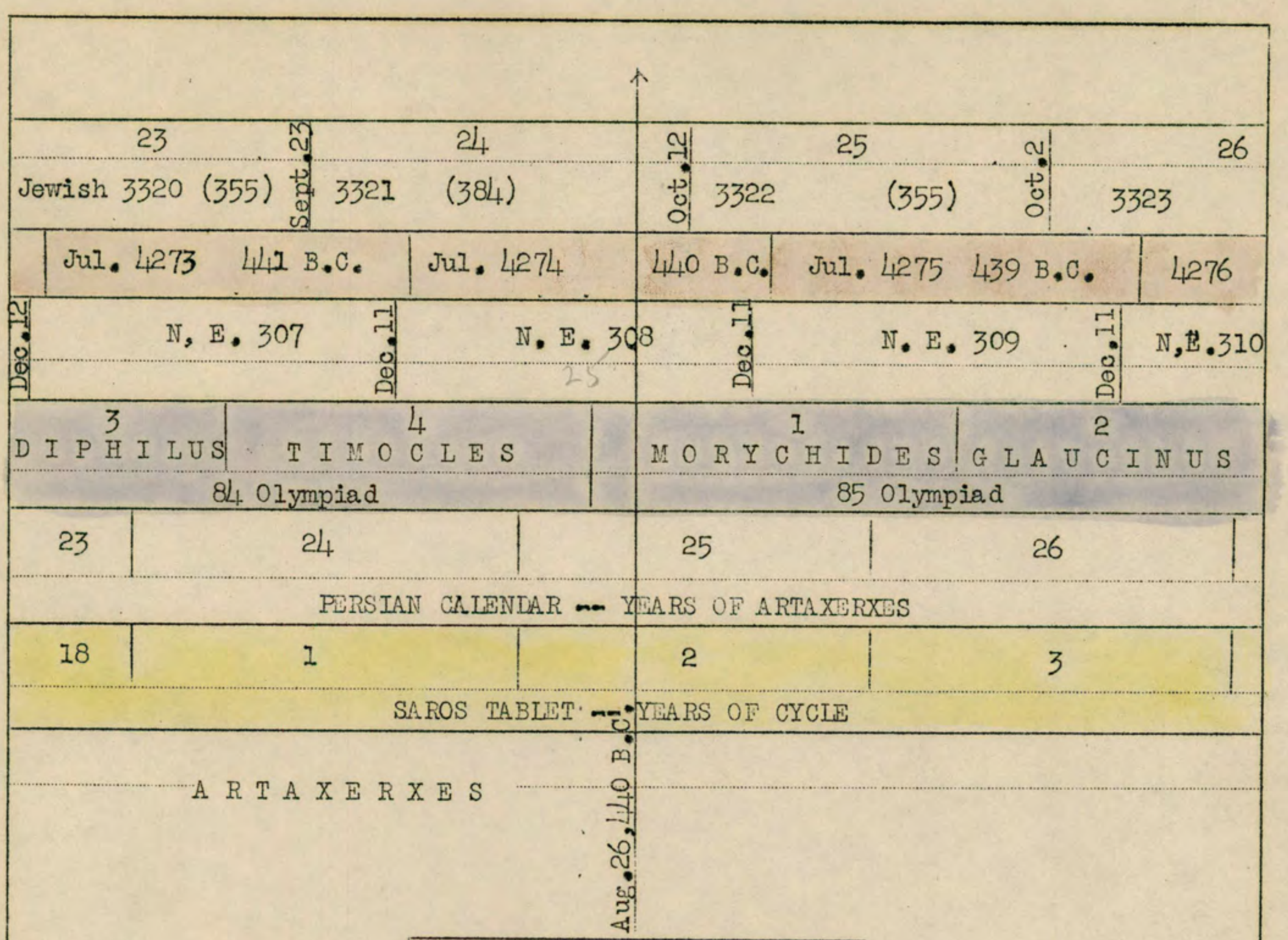
"Papyrus B"
Dated 21 Year Xerxes
18 Chisleu
= 17 (?) Thoth
1 Year Artaxerxes
Sayce & Cowley - <u>Aramaic Papyri Discovered at Assuan</u>



"Papyrus H"

Dated: -[3d year Darius]
Month of Elul
4th year Darius
Month of Payni

Sayce & Cowley:-- Aramaic Papyri Discovered at Assuan



"Papyrus F"
Dated: [24th year Artaxerxes]
14th Ab
= 25th year Artaxerxes
19th Pachons
Sayce & Cowley: -- Aramaic Papyri Discovered at Assuan

17	Sept.30	18	Sept.20	19	Oct.7	20
Jewish		3315 (355)		3316 (383)		3317 (354)

Jul. 4267 447 B.C.	Jul. 4268 446 B.C.	Jul. 4269 445 B.C.	Jul. 4270

N. E. 301	Dec.13	N. E. 302	Dec.13	N. E. 303	Dec.13	N. E. 304
18		19		20		21

	2		3	4
	TIMARCHIDES	CALLIMACHUS		LYSIMACHIDES

83 Olympiad

18	19	20	

PERSIAN CALENDAR -- YEARS OF ARTAXERXES

13	14	15	

SAROS TABLET -- YEARS OF CYCLE

Nov.17, 446

ARTAXERXES

"Papyrus E"
Dated: - 19th yr. Artaxerxes
3d Chisleu - 10th Mesore
Sayce & Cowley: -- Aramaic Papyri Discovered at Assuan

13 3289 (354) Oct.6 | 14 Jewish 3290 (354) | Sept.25 | 15 3291 (384) Oct.14 | 16 3292

Julian 4242 472 B.C. | Jul. 4243 471 B.C. | Jul. 4244 470 B.C. | Jul. 4245

N. E. 276 14 | Dec.19 | N. E. 277 15 | Dec.19 | N. E. 278 16 | Dec.19 | 279 17

4 | 1 C H A R E S | 2 P R A X I E R G U S | 3 D E M O T I O N

77 Olympiad

14 | 15 | 16

PERSIAN CALENDAR -- YEARS OF XERXES

6 | 7 | 8

SAROS TABLET -- YEARS OF CYCLE

X E R X E S

Sept.12, 471 B.C.

"Papyrus A"
Dated: [14]-15 Year Xerxes
18th Elul = 28th Pachons
Sayce & Cowley: - <u>Aramaic Papyri Discovered at Assuan</u>

These papyri extending over more than 60 years during the days of the Persian period constitute the best archaeological evidence possible for determining the accurate B. C. date for the 7th year of Artaxerxes. Papyrus "B" shows definitely that according to the Jewish reckoning the 1st year of Artaxerxes began October 8, 464. The following table shows the dates for the beginning of the succeeding years.

Year of Artaxerxes	Julian date B.C. for beginning of the civil New Year Sunset Jerusalem
1	October 8, 464
2	September 27, 463
3	October 16, 462
4	October 4, 461
5	September 23, 460
6	October 12. 459
7	October 2, 458
8	September 20, 457

For the readers convenience tables showing the list of kings in Ptolemy's Canon (p. 15) and regnal synchronisms running from 626 B.C. to 515 B. C. (p. 16) are attached herewith.

TABLE OF SYNCHRONISMS BETWEEN THE CALENDARS
OF THE
EGYPTIANS, BABYLONIANS, PERSIANS AND JEWS
DURING THE NEO-BABYLONIAN AND PERSIAN PERIODS

Total Length of Reign	King's Name	Regnal Year 1 = Canon Year	Inclusive Dates in Julian Time as Given by the Ptolemaic Canon	Death Year = Accession Year Jewish (Fall-fall)	First Year Jewish (Fall-fall)	First Year Bab.-Per. (Spring - Spring)
21	Nabopolassar	123	January 27, 625 January 20, 604	626 - 625	625 - 624	625 - 624
43	Nebuchadnezzar	144	January 21, 604 January 10, 561	605 - 604	604 - 603	604 - 603
2	Amel Marduk	187	January 11, 561 January 9, 559	562 - 561	561 - 560	561 - 560
4	Nergal Sarusur	189	January 10, 559 January 8, 555	560 - 559	559 - 558	559 - 558
17	Nabonidus (Belshazzar)	193	January 9, 555 January 4, 538	556 - 555	555 - 554	555 - 554
9	Cyrus (Darius the Mede)	210	January 5, 538 January 2, 529	Dar. the Mede 539 - 538	538 - 537	538 - 537
				Cyrus 537 - 536	536 - 535	
8	Cambyses	219	January 3, 529 December 31, 522	530 - 529	529 - 528	529 - 528
36	Darius I	227	January 1, 521 December 22, 486	522 - 521	521 - 520	521 - 520
21	Xerxes	263	December 23, 486 December 16, 465	486 - 485	485 - 484	485 - 484
41	Artaxerxes	284	December 17, 465 December 6, 424	465 - 464	464 - 463	464 - 463
19	Darius II	325	December 7, 424 December 1, 405	424 - 423	423 - 422	423 - 422
46	Artaxerxes II	344	December 2, 405 November 20, 359	405 - 404	404 - 403	404 - 403
21	Ochos or Artaxerxes III	390	November 21, 359 November 15, 338	359 - 358	358 - 357	358 - 357
2	Arses	411	November 16, 338 November 14, 336	338 - 337	337 - 336	337 - 336
4	Darius III	413	November 15, 336 November 13, 332	336 - 335	335 - 334	335 - 334
8	Alexander	417	November 14, 332 November 11, 324	332 - 331	331 - 330	331 - 330

No account is taken by the Canon of Ptolemy of kings reigning less than a year. Their dates must be figured in such a way as not to disturb the balance preserved between other reigns as verified by the "saros tablet."

CHART G

REGNAL SYNCHRONISMS
of the
JULIAN, PTOLEMAIC, AND JEWISH CALENDARS

626	625	624	623	622	621	620	Julian	618	617	616	615	614	613
	1	2	N.E.	4	5	6	7	Nabopolassar		10	11	12	13
	22 } A	1	2	Jewish	4	5	6	Nabopolassar		9	10	11	12
	13	14	15	16	17	Josiah		20	21	22	23	24	25

612	611	610	609	608	607	606	605	604	603	Julian	601	600	599
14	15	16	17	N.E.	19	20	21	1	2	Nebuchadnezzar		5	6
13	14	15	16	Jewish	18	19	20	21 } A	1	Nebuchadnezzar			5
26	27	28	29	30	31 } A	1	2	Jehoiakim		5	6	7	8

598	597	596	595	594	593	592	Julian	590	589	588	587	586	585
7	8	9	10	Nebuchadnezzar			14	15	16	N.E.	18	19	20
6	7	8	9	10	Nebuchadnezzar			14	15	16	17	18	19
9	10	11 } A	1	2	Zedekiah		5	6	7	8	9	10	11

584	583	582	581	580	Julian	578	577	576	575	574	573	572	571
21	22	N.E.	24	25	26	Nebuchadnezzar			30	31	32	33	34
20	21	22	23	Jewish	25	26	27	28	29	Nebuchadnezzar			33

570	569	568	567	566	565	Julian	563	562	561	560	559	558	557
35	36	37	N.E.	39	40	41	42	43	1	2	1	2	3
34	35	36	37	Jewish	39	40	41	42	43 } A	1	2 } A	1	2

Amel Marduk → 1

Nergal Sarusur → A

556	555	554	553	552	551	550	549	Julian	547	546	545	544	543
4	1	2	3	N.E.	5	6	7	8	Nabonidus		11	12	13
3	4 } A	1	2	3	4	Jewish	6	7	8	9	Belshazzar	11	12

542	541	540	539	538	537	536	Julian	534	533	532	531	530	529
14	15	N.E.	17	1	2	3	4	Cyrus		7	8	9	1
13	Jewish	15	16	17 } A	1	2 } A	1	2	Cyrus		5	6	7 } A

Darius the Mede → 1

528	527	526	525	524	523	522	521	520	519	Julian	517	516	515
2	N.E	4	Cambyses		7	8	1	2	3	4	Darius		7
1	2	Cambyses		5	Jewish	7	8 } } A	1	2	Darius		5	6

Gaumata → }

THE JEWISH CALENDAR IN THE FIFTH CENTURY B. C.

Introductory Note:

The papyri documents under consideration came from a Jewish colony established at Elephantine near the Nubian frontier under the protection of a Persian garrison. As early as 1878, it was recognized that the Aramaic papyri coming from Egypt pertained to the Persian administration in the age of Ezra and Nehemiah. Some of these papyri were found rolled up, tied and sealed. For nearly 2500 years, these seals had remained unbroken. Of additional interest is the fact that these texts were written by Jews, and, outside of the Bible, are among the earliest Jewish writings. In the words of the translator Mr. Cowley, "they present therefore a trustworthy picture of their surroundings, not distorted by lapse of time, nor obscured by textual corruption." ("Aramaic Papyri in the Fifth Century B. C.," Preface, p. xiv). Oxford, 1923.)

The confusion between modern Jewish computation and early Jewish reckoning, led the Greek author, M. L. Belleli, to doubt the authenticity of the Elephantine papyri, concerning which M. M. Sayce and A. E. Cowley made their report in 1900. After examining the double Semitic dates in these valuable documents, and finding them not in agreement with the modern Jewish calendar, Mr. Belleli summarily concluded that they were not authentic, completely overlooking the fact that in the 5th century B. C., modern Jewish computation had not yet been devised. The unsoundness of this opinion and conclusion has been ably refuted by various authors; furthermore, the futility of applying the principles of modern Jewish calendation to the Aramaic dates has been shown by Dr. Fotheringham in his criticism of E. B. Knobel's date argument ("Monthly Notices of the Royal Astronomical Society," Vol. LXIX, p. 12, ff. London, 1909).

Many attempts have been made by chronologers to reconstruct synthetically, an ancient method of Jewish calendation. The fact that modern Rabbinical computation does not agree with early Jewish dates is generally recognized; but, even though this is often stressed, yet, the simple Mosaic principles that governed early Jewish time are almost completely overlooked. An important feature of the ancient history written in the various papyri, about which there is no doubt, relates to an order from the Persian king, Darius II, to keep the passover.

The command concerning the Passover was given in few words: "In the month of Tybi (?) let there be a Passover for the Jewish garrison" ("Aramaic Papyri in the Fifth Century B. C.," p. 60). The date is the 5th year of Darius. Although the papyrus is imperfect, and somewhat broken, yet enough remains to show that it gives instructions to keep the festival of unleavened bread. The edict continues: "Now you accordingly count fourteen days of the month Nisan, and keep the Passover, and from the 15th day to the 21st day of Nisan (are) seven days of Unleavened bread. Be clean and take heed. Do no work on the 15th day, and on the 21st day. Also drink no beer, and anything at all in which there is leaven do not eat, from the 15th day from sunset till the 21st day of Nisan, seven days, let it not be seen among you; do not bring (it) into your dwellings, but seal (it) up during these days. Let this be done as Darius the king commanded. (Address) To my brethren Yedoniah and his colleagues the Jewish garrison, your brother Hananiah" ("Idem," p. 63). Cowley's comment on this passover edict (Papyrus "No. 6" of Ungnad, and "Plate 6" of Sachau) is that it "removes all reason for doubting the genuineness of the Persian letters [by Artaxerxes] in Ezra" ("Idem," p. 62).

The papyri themselves, therefore, show that the members of the Jewish garrison in Elephantine and Assuan were fully acquainted with the Mosaic passover regulations that commanded this feast to be kept at sunset (Deut. 16:6) on the 14th of Nisan (Ex. 12:6). Consequently, it is fully in harmony with the circumstances forming the background of the Aramaic dates to offer a method of interpretation that is based on passover observance. The calendric outline (page 21) pertaining to the Aramaic or Jewish dates, has already been applied to the crucifixion date problem. In this calendar problem, it is employed in a specific form as representative of Mosaic calendation.

The Egyptian calendar made use of in this solution is the same as has been standardized for Egyptian time, with the exception, that in harmony with Ptolemy's reckoning of intervals. and eclipses, Oppolzer's "Canon," and the testimony of Censorinus, the Era of Nabonassar is made to begin on February 27 instead of February 26.

OUTLINE OF DISCUSSION

1. Introductory Note pp. i,ii,iii
2. Egyptian New Year Table pp. 1,2
   Jewish Passover Table p. 3
3. Tables I, II, and III -- Analogue of Ancient Dates and Eclipses p. 4
4. Cycle Table (IV) in time of Ezra and Nehemiah p. 5
5. Papyrus References pp. 6-8
6. Eclipse References pp. 9,10
7. Discussion of Problem pp. 11-19
8. Conclusion pp. 20,21
9. Nabonassar Era -- Leap Year Table (V) p. 5-a

EGYPTIAN NEW YEAR (1 THOTH) TABLE AND ITS JULIAN EQUIVALENT DATE
(NOON TO NOON, ASTRONOMICAL TIME -- FROM 1356 B.C. TO 238 A.D.)*

B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth
824	748-Feb 27	672	596	520	444	368
823	747 Nabonassar	671	595	519	443	367
822	746 Era	670	594	518	442	366
821-Mar 16	745-Feb 26	669-Feb 7	593-Jan 19	517-Dec 31	441-Dec 12	365-Nov 23
820	744	668	592	516	440 Papyrus "F"	364
819	743	667	591	515	439 Papyrus "G"	363
818	742	666	590	514	438	362
817-Mar 15	741-Feb 25	665-Feb 6	589-Jan 18	513-Dec 30	437-Dec 11	361-Nov 22
816	740	664	588	512	436	360
815	739	663	587	511	435	359
814	738	662	586	510	434	358
813-Mar 14	737-Feb 24	661-Feb 5	585-Jan 17	509-Dec 29	433-Dec 10	357-Nov 21
812	736	660	584	508	432	356
811	735	659	583	507	431	355
810	734	658	582	506	430	354
809-Mar 13	733-Feb 23	657-Feb 4	581-Jan 16	505-Dec 28	429-Dec 9	353-Nov 20
808	732	656	580	504	428	352
807	731	655	579	503	427	351
806	730	654	578	502	426	350
805-Mar 12	729-Feb 22	653-Feb 3	577-Jan 15	501-Dec 27	425-Dec 8	349-Nov 19
804	728	652	576	500	424	348
803	727	651	575	499	423	347
802	726	650	574	498	422	346
801-Mar 11	725-Feb 21	649-Feb 2	573-Jan 14	497-Dec 26	421-Dec 7	345-Nov 18
800	724	648	572	496	420 Papyrus "H"	344
799	723	647	571	495	419	343
798	722	646	570	494	418	342
797-Mar 10	721-Feb 20	645-Feb 1	569-Jan 13	493-Dec 25	417-Dec 6	341-Nov 17
796	720	644	568	492	416 Papyrus "J"	340
795	719	643	567	491	415	339
794	718	642	566	490	414	338
793-Mar 9	717-Feb 19	641-Jan 31	565-Jan 12	489-Dec 24	413-Dec 5	337-Nov 16
792	716	640	564	488	412	336
791	715	639	563	487	411	335
790	714	638	562	486	410 Papyrus "K"	334
789-Mar 8	713-Feb 18	637-Jan 30	561-Jan 11	485-Dec 23	409-Dec 4	333-Nov 15
788	712	636	560	484	408	332
787	711	635	559	483	407	331
786	710	634	558	482	406	330
785-Mar 7	709-Feb 17	633-Jan 29	557-Jan 10	481-Dec 22	405-Dec 3	329-Nov 14
784	708	632	556	480	404	328
783	707	631	555	479	403	327
782	706	630	554	478	402	326
781-Mar 6	705-Feb 16	629-Jan 28	553-Jan 9	477-Dec 21	401-Dec 2	325-Nov 13
780	704	628	552	476	400	324
779	703	627	551	475	399	323
778	702	626	550	474	398	322
777-Mar 5	701-Feb 15	625-Jan 27	549-Jan 8	473-Dec 20	397-Dec 1	321-Nov 12
776	700	624	548	472	396	320
775	699	623	547	471 Papyrus "A"	395	319
774	698	622	546	470	394	318
773-Mar 4	697-Feb 14	621-Jan 26	545-Jan 7	469-Dec 19	393-Nov 30	317-Nov 11
772	696	620	544	468	392	316
771	695	619	543	467	391	315
770	694	618	542	466	390	314
769-Mar 3	693-Feb 13	617-Jan 25	541-Jan 6	465-Dec 18	389-Nov 29	313-Nov 10
768	692	616	540	464 Papyrus"B"	388	312
767	691	615	539	463	387	311
766	690	614	538	462	386	310
765-Mar 2	689-Feb 12	613-Jan 24	537-Jan 5	461-Dec 17	385-Nov 28	309-Nov 9
764	688	612	536	460 Papyrus "D"	384	308
763	687	611	535	459	383	307
762	686	610	534	458	382	306
761-Mar 1	685-Feb 11	609-Jan 23	533-Jan 4	457-Dec 16	381-Nov 27	305-Nov 8
760	684	608	532	456	380	304
759	683	607	531	455	379	303
758	682	606	530	454	378	302
757-Feb 29	681-Feb 10	605-Jan 22	529-Jan 3	453-Dec 15	377-Nov 26	301-Nov 7
756	680	604	528	452	376	300
755	679	603	527	451 Papyrus	375	299
754	678	602	526	450 Ungnad "30"	374	298
753-Feb 28	677-Feb 9	601-Jan 21	525-Jan 2	449-Dec 14	373-Nov 25	297-Nov 6
752	676	600	524	448	372	296
751	675	599	523 Cambyse	447 Papyrus "E"	371	295
750	674	598	522 Tablet	446	370	294
749-Feb 27	673-Feb 8	597-Jan 20	521-Jan 1	445-Dec 13	369-Nov 24	293-Nov 5

* This period covers the Sothic Cycle from 1322 B.C. to 139 A.D. Date of 1 Thoth is placed opposite the Julian leap year, at which time it occurs a day earlier, and continues for four years. For example, February 27 is Egyptian new year day for years 749 to 746 B.C.

EGYPTIAN NEW YEAR (1 THOTH) TABLE AND ITS JULIAN EQUIVALENT DATE
(NOON TO NOON, ASTRONOMICAL TIME -- FROM 1356 B.C. TO 238 A.D.)*

B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth	B.C. 1 Thoth	A.D. 1 Thoth	A.D. 1 Thoth	A.D. 1 Thoth
292	216	140	64	13	89	165
291	215	139	63	14	90	166
290	214	138	62	15	91	167
289-Nov 4	213-Oct 16	137-Sep 27	61-Sep 8	16-Aug 20	92-Aug 1	168-Jul 13
288	212	136	60	17	93	169
287	211	135	59	18	94	170
286	210	134	58	19	95	171
285-Nov 3	209-Oct 15	133-Sep 26	57-Sep 7	20-Aug 19	96-Jul 31	172-Jul 12
284	208	132	56	21	97	173
283	207	131	55	22	98	174
282	206	130	54	23	99	175
281-Nov 2	205-Oct 14	129-Sep 25	53-Sep 6	24-Aug 18	100-Jul 30	176-Jul 11
280	204	128	52	25	101	177
279	203	127	51	26	102	178
278	202	126	50	27	103	179
277-Nov 1	201-Oct 13	125-Sep 24	49-Sep 5	28-Aug 17	104-Jul 29	180-Jul 10
276	200	124	48	29	105	181
275	199 Rosetta	123	47	30	106	182
274	198 Stone	122	46	31	107	183
273-Oct 31	197-Oct 12	121-Sep 23	45-Sep 4	32-Aug 16	108-Jul 28	184-Jul 9
272	196	120	44	33	109	185
271	195	119	43	34	110	186
270	194	118	42	35	111	187
269-Oct 30	193-Oct 11	117-Sep 22	41-Sep 3	36-Aug 15	112-Jul 27	188-Jul 8
268	192	116	40	37	113	189
267	191	115	39	38	114	190
266	190	114	38	39	115	191
265-Oct 29	189-Oct 10	113-Sep 21	37-Sep 2	40-Aug 14	116-Jul 26	192-Jul 7
264	188	112	36	41	117	193
263	187	111	35	42	118	194
262	186	110	34	43	119	195
261-Oct 28	185-Oct 9	109-Sep 20	33-Sep 1	44-Aug 13	120-Jul 25	196-Jul 6
260	184	108	32	45	121	197
259	183	107	31	46	122	198
258	182	106	30	47	123	199
257-Oct 27	181-Oct 8	105-Sep 19	29-Aug 31	48-Aug 12	124-Jul 24	200-Jul 5
256	180	104	28	49	125	201
255	179	103	27	50	126	202
254	178	102	26	51	127	203
253-Oct 26	177-Oct 7	101-Sep 18	25-Aug 30	52-Aug 11	128-Jul 23	204-Jul 4
252	176	100	24	53	129	205
251	175	99	23	54	130	206
250	174	98	22	55	131	207
249-Oct 25	173-Oct 6	97-Sep 17	21-Aug 29	56-Aug 10	132-Jul 22	208-Jul 3
248	172	96	20	57	133	209
247	171	95	19	58	134	210
246	170	94	18	59	135	211
245-Oct 24	169-Oct 5	93-Sep 16	17-Aug 28	60-Aug 9	136-Jul 21	212-Jul 2
244	168	92	16	61	137	213
243	167	91	15	62	138 End of	214
242	166	90	14	63	139 Sothic Cycle	215
241-Oct 23	165-Oct 4	89-Sep 15	13-Aug 27	64-Aug 8	140-Jul 20	216-Jul 1
240	164	88	12	65	141	217
239	163	87	11	66	142	218
238	162	86	10	67	143	219
237-Oct 22	161-Oct 3	85-Sep 14	9-Aug 26	68-Aug 7	144-Jul 19	220-Jun 30
236	160	84	8	69	145	221
235	159	83	7	70	146	222
234	158	82	6	71	147	223
233-Oct 21	157-Oct 2	81-Sep 13	5-Aug 25	72-Aug 6	148-Jul 18	224-Jun 29
232	156	80	4	73	149	225
231	155	79	3	74	150	226
230	154	78	2	75	151	227
229-Oct 20	153-Oct 1	77-Sep 12	1-Aug 24	76-Aug 5	152-Jul 17	228-Jun 28
228	152	76	1	77	153	229
227	151	75	2	78	154	230
226	150	74	3	79	155	231
225-Oct 19	149-Sep 30	73-Sep 11	4-Aug 23	80-Aug 4	156-Jul 16	232-Jun 27
224	148	72	5	81	157	233
223	147	71	6	82	158	234
222	146	70	7	83	159	235
221-Oct 18	145-Sep 29	69-Sep 10	8-Aug 22	84-Aug 3	160-Jul 15	236-Jun 26
220	144	68	9	85	161	237
219	143	67	10	86	162	238 Censorinus
218	142	66	11	87	163	239
217-Oct 17	141-Sep 28	65-Sep 9	12-Aug 21	88-Aug 2	164-Jul 14	240-Jun 25

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* This period covers the Sothic Cycle from 1322 B.C. to 139 A.D. Date of 1 Thoth is placed opposite the Julian leap year, at which time it occurs a day earlier, and continues for four years. For example, February 27 is Egyptian new year day for years 749 to 746 B. C.

PASSOVER METHOD FOR DETERMINING JULIAN EQUIVALENT OF ARAMAIC DATES*

YEAR	FULL MOON G.M.T.**	NISAN 13 J.C.T.	NISAN 14 J.C.T.	NISAN 1 J.C.T.	CONJUNCTION JER. CIV. T.	TRANSLATION PERIOD (DAYS)	LENGTH OF YEAR (DAYS)	
481	May 4.04	4.63	May 5	Apr 22	Apr 19.28	2.47		
480	Apr 23.12	23.71	Apr 24	Apr 11	Apr 8.99	1.76	(11) 354	
479	Apr 12.16	12.75	Apr 14	Apr 1	Mar 29.64	2.10	(12) 355	
478	Apr 30.93	31.52	May 2	Apr 19	Apr 17.58	1.16	(13) 383	
477	Apr 19.38	19.97	Apr 21	Apr 8	Apr 5.90	1.84	(14) 355	
476	Apr 9.03	9.62	Apr 10	Mar 28	Mar 25.95	1.79	(15) 354	
475	Apr 28.04	28.63	Apr 29	Apr 16	Apr 13.64	2.10	(16) 384	
474	Apr 17.71	18.30	Apr 19	Apr 6	Apr 2.80	2.94	(17) 355	
473	May 5.62	6.21	May 7	Apr 24	Apr 20.68	3.06	(18) 384	
472	Apr 24.89	25.48	Apr 26	Apr 13	Apr 10.27	2.47	(19) 354	6939 DAYS
471	Apr 13.93	14.52	Apr 15	Apr 2	Mar 30.98	1.76	(1) 354	
470	May 2.61	3.20	May 4	Apr 21	Apr 18.99	1.75	(2) 384	
469	Apr 20.83	21.42	Apr 22	Apr 9	Apr 7.51	1.23	(3) 354	
468	Apr 10.35	10.94	Apr 12	Mar 30	Mar 27.73	2.01	(4) 355	
467	Apr 29.34	29.93	May 1	Apr 18	Apr 15.42	2.32	(5) 384	
456	Apr 19.06	19.65	Apr 20	Apr 7	Apr 4.45	2.29	(6) 354	
455	May 7.04	7.63	May 8	Apr 25	Apr 22.21	2.53	(7) 384	
464	Apr 26.52	27.11	Apr 28	Apr 15	Apr 11.63	3.11	(8) 355	
463	Apr 15.73	16.32	Apr 17	Apr 4	Apr 1.29	2.45	(9) 354	
462	May 4.40	4.99	May 6	Apr 23	Apr 20.30	2.44	(10) 384	19 YEAR
461	Apr 22.45	23.04	Apr 24	Apr 11	Apr 8.96	1.78	(11) 354	CYCLE
460	Apr 11.75	12.34	Apr 13	Mar 31	Mar 29.40	1.34	(12) 354	
459	Apr 30.68	31.27	May 2	Apr 19	Apr 17.18	1.56	(13) 384	
458	Apr 20.36	20.95	Apr 22	Apr 9	Apr 6.23	2.51	(14) 355	
457	Apr 9.05	9.64	Apr 10	Mar 28	Mar 25.31	2.43	(15) 354	
456	Apr 28.02	28.61	Apr 29	Apr 16	Apr 13.12	2.62	(16) 384	
455	Apr 17.44	18.03	Apr 19	Apr 6	Apr 2.61	3.12	(17) 355	
454	May 6.18	6.77	May 8	Apr 25	Apr 21.59	3.15	(18) 384	
453	Apr 24.22	24.81	Apr 26	Apr 13	Apr 10.31	2.43	(19) 354	6940 DAYS
452	Apr 13.32	13.91	Apr 15	Apr 2	Mar 30.92	1.82	(1) 354	
451	May 2.14	2.73	May 4	Apr 21	Apr 18.82	1.92	(2) 383	
450	Apr 21.67	22.26	Apr 23	Apr 10	Apr 8.02	1.72	(3) 355	
449	Apr 10.36	10.95	Apr 12	Mar 30	Mar 27.05	2.69	(4) 355	
448	Apr 29.38	29.97	May 1	Apr 18	Apr 14.76	2.98	(5) 384	
447	Apr 18.97	19.56	Apr 20	Apr 7	Apr 4.02	2.72	(6) 354	
446	Apr 8.30	8.89	Apr 10	Mar 28	Mar 24.59	3.15	(7) 355	(384)
445	Apr 26.02	26.61	Apr 27	Apr 14	Apr 11.61	2.13	(8) 383	(354)
444	Apr 15.04	15.63	Apr 16	Apr 3	Apr 1.31	1.43	(9) 354	Change of
443	May 3.74	4.33	May 5	Apr 22	Apr 20.28	1.46	(10) 384	Embolism
442	Apr 23.07	23.66	Apr 24	Apr 11	Apr 9.71	1.03	(11) 354	
441	Apr 11.67	12.26	Apr 13	Mar 31	Mar 28.84	1.90	(12) 355	
440	Apr 30.69	31.28	May 2	Apr 19	Apr 16.52	2.22	(13) 384	19 YEAR
439	Apr 20.37	20.95	Apr 22	Apr 9	Apr 5.60	3.14	(14) 355	CYCLE
438	Apr 9.90	10.49	Apr 11	Mar 29	Mar 25.97	2.77	(15) 354	
437	Apr 27.72	28.31	Apr 29	Apr 16	Apr 12.92	2.82	(16) 384	
436	Apr 16.83	17.42	Apr 18	Apr 5	Apr 2.61	2.13	(17) 354	
435	May 5.50	6.09	May 7	Apr 24	Apr 21.62	2.12	(18) 384	
434	Apr 24.61	25.20	Apr 26	Apr 13	Apr 11.24	1.50	(19) 354	6939 20818=
433	Apr 13.02	13.61	Apr 14	Apr 1	Mar 30.58	1.16	(1) 354	DAYS
432	May 1.97	2.56	May 3	Apr 20	Apr 18.30	1.44	(2) 384	IN 3
431	Apr 21.68	22.27	Apr 23	Apr 10	Apr 7.33	2.41	(3) 355	CYCLES
430	Apr 11.36	11.95	Apr 13	Mar 31	Mar 27.48	3.26	(4) 355	
429	Apr 29.27	29.86	May 1	Apr 18	Apr 14.34	3.40	(5) 384	
428	Apr 18.57	19.16	Apr 20	Apr 7	Apr 3.91	2.83	(6) 354	
427	May 7.29	7.88	May 9	Apr 26	Apr 22.92	2.83	(7) 384	
426	Apr 26.31	26.90	Apr 28	Apr 15	Apr 12.63	2.11	(8) 354	
425	Apr 14.50	15.09	Apr 16	Apr 3	Apr 1.16	1.58	(9) 354	
424	May 3.37	3.96	May 5	Apr 22	Apr 19.99	1.75	(10) 384	19 YEAR
423	Apr 22.98	23.57	Apr 24	Apr 11	Apr 9.11	1.63	(11) 354	CYCLE
422	Apr 12.70	13.29	Apr 14	Apr 1	Mar 29.14	2.60	(12) 355	
421	Apr 30.69	31.28	May 2	Apr 19	Apr 15.89	2.85	(13) 384	
420	Apr 20.20	20.79	Apr 22	Apr 9	Apr 5.28	3.46	(14) 355	
419	Apr 9.41	10.00	Apr 11	Mar 29	Mar 25.91	2.83	(15) 354	
418	Apr 28.09	28.68	Apr 29	Apr 16	Apr 13.93	1.81	(16) 383	
417	Apr 16.14	16.73	Apr 18	Apr 5	Apr 2.61	1.12	(17) 354	
416	May 4.90	5.49	May 6	Apr 23	Apr 21.54	1.20	(18) 384	
415	Apr 24.34	24.93	Apr 26	Apr 13	Apr 10.86	1.88	(19) 355	6940 27758=
414	Apr 13.98	14.57	Apr 15	Apr 2	Mar 30.92	1.82	(1) 354	DAYS
413	May 2.00	2.59	May 3	Apr 20	Apr 17.60	2.14	(2) 384	IN 4
412	Apr 21.67	22.26	Apr 23	Apr 10	Apr 6.78	2.96	(3) 355	CYCLES
411	Apr 11.09	11.68	Apr 12	Mar 30	Mar 27.24	2.50	(4) 354	
410	Apr 29.86	30.45	May 1	Apr 18	Apr 15.23	2.51.	(5) 384	
409	Apr 17.90	18.49	Apr 19	Apr 6	Apr 3.93	1.81	(6) 354	
408	May 6.59	7.18	May 8	Apr 25	Apr 22.93	1.82	(7) 384	
407	Apr 25.80	26.39	Apr 27	Apr 14	Apr 12.46	1.28	(8) 354	
							(9) 355	

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* The Passover dates, reckoned from full moon, determine length of year, which, in turn, establishes the length of each month.

** Ginzel, "Handbuck der mathematischen und technischen Chronologie," Vol. II. Astronomical dates are reduced to Jerusalem Civil Time (J.C.T.) by adding to each G.M.T. date $14^h 20^m$, or .59 of a day.

Ancient Egyptian Monument Dates, Based on 365-Day Year
Ptolemy's "Mathematical Syntaxis," the Reckoning
of which Began at Noon, Feb. 26/27, 747 B.C.

ANALOGUE OF ANCIENT EGYPTIAN, JEWISH, AND MACEDONIAN DATES

A Calendar Problem

Ancient Aramaic Observation Dates of Papyrus, Tablet,
and Stone Computed in Jerusalem Civil Time (Julian
Calendar) from Ginzel Tables.

TABLE I EGYPTIAN CALENDAR (Alexandrian Astronomical Time)

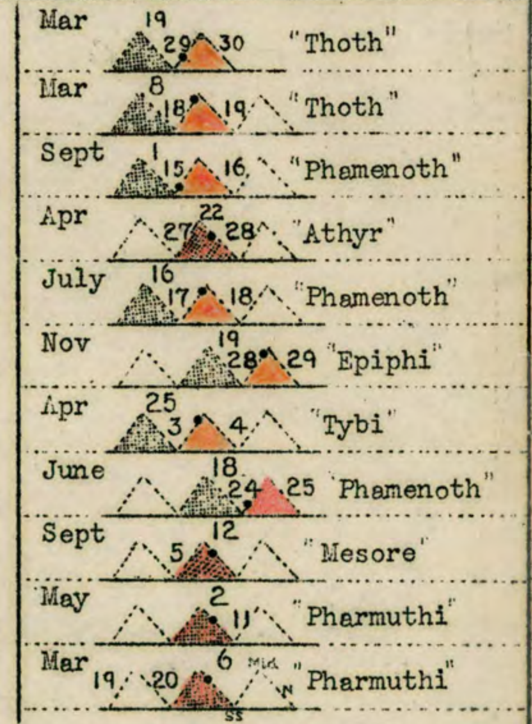
Series Number* 1	Persian Regnal Year 2	Julian Year B. C. 3	Date of 1 Thoth (pp.1,2) 4	Egyptian Date on Papyrus 5	Egyptian Interval From 1 Th. 6	Julian Date Alex. M.T. Noon 7	Calendar Difference 8
1 "400"	7 Cambyses	523	Jan. 2	17 Phamenoth	196	July 17	+1
2 "A"	15 Xerxes	471	Dec. 20	28 Pachons	267	Sept 13	+1
3 "B"	1 Artaxerxes	465	Dec. 18	17 Thoth	16	Jan 3	+1
4 "D"	6 Artaxerxes	460	Dec. 17	1 Mesore	330	Nov 12	+1
5 "30"	9 Artaxerxes	451	Dec. 15	4 Thoth	3	Dec 18	+1
6 "E"	19 Artaxerxes	447	Dec. 14	10 Mesore	339	Nov 18	+2
7 "F"	25 Artaxerxes	440	Dec. 12	19 Pachons	258	Aug 27	+1
8 "G"	No Year	439	Dec. 12	6 Epiphi	305	Oct 13	+1
9 "H"	4 Darius	420	Dec. 7	Payni	269-299	Sept 1 to Oct 1	+1
10 "J"	9 Darius	416	Dec. 6	12 Thoth	11	Dec 17	+1
11 "K"	14 Darius	410	Dec. 5	8 or 9 Athyr	67	Feb 10	+1
12 "R.S."	9 Ptol. Epiph.	199	Oct. 13	18 Mechir	167	Mar 29	+1

TABLE II ARAMAIC (JEWISH) CALENDAR (Jerusalem Civil Time)

Jewish Regnal Year 9	Passover 14 Nisan J.C.T. 10	Year Length (Days) 11	1 Nisan Civil Date 12	Translation Period 13	Aramaic Date on Papyrus 14	Aramaic Interval From 1 Nis. 15	Julian Equivalent Date Jer.C.T. 16
7 Cambyses	Apr 20		Apr 7	1.75	14 Tammuz	102	July 18
14 Xerxes	Apr 15	384	Apr 2	1.76	18 Elul	165	Sept 14
21 Xerxes	May 8	355	Apr 25	2.53	18 Kisleu	254	Jan 4
5 Artaxerxes	Apr 13	384	Mar 31	1.35	21 "Hesvan"	227	Nov 13
8 Artaxerxes	May 4	354	Apr 21	1.93	7 Kisleu	242	Dec 19
19 Artaxerxes	Apr 10	383	Mar 28	3.15	2 Kisleu	237	Nov 20
24 Artaxerxes	May 2	355	Apr 19	2.22	14 Ab	131	Aug 28
No year	Apr 22	354	Apr 9	3.15	23 Tisri	199	Oct 14
3 Darius	Apr 22	354	Apr 9	3.46	Elul	147-176	Sept 3 to Oct 2
8 Darius	May 6	355	Apr 23	1.20	3 Kisleu	239	Dec 18
13 Darius	Apr 12	384	Mar 30	2.50	24 Shebat	318	Feb 11
8 Ptol. Epiph.	Apr 9		Mar 27	3.33	4 Xanthicus	3	Mar 30

TABLE III PTOLEMAIC LUNAR ECLIPSE CHECK ON EGYPTIAN NEW YEAR TABLE

Series Number* 1	Regnal Year 2	Julian Year B. C. 3	Date of 1 Thoth (pp. 1,2) 4	Egyptian Interval From 1 Th. 5	Oppolzer's Julian Dates of Eclipses (Green. Civ.Time) 6	Ptolemaic and Exact Eclipses	Egyptian Dates Position of (pp. 9,10) 7	Full Moon Date of Eclipses(Ginzel) (Alex. Civ. Time) 8	Computation of Eclipses in Ptolemy's Catalog by Egyptian New Year Table (Alexandrian Civil Time) 9
1	1 Mardokempad	721	Feb. 21	27	Mar 19	"Thoth"	"3 1/3 hr. before mid."	Mar 19.91[a]	Feb 21+27=8+19=Mar 19
2	2 Mardokempad	720	" 20	16	Mar 8	"Thoth"	"5/6 hr. before midnight."	Mar 9.06[a]	Feb 20+16=8+8=Mar 8
3	2 Mardokempad	720	" "	179+14	Sept 1	"Phamenoth"	"4 1/3 hr. before midnight"	Sept 1.76[a]	Feb 20+193=8+31+30+31+30+31+31+1=Sept 1
4	5 Nabopollassar	621	Jan. 27	59+27	Apr 22	"Athyr"	"5 hr. after midnight"	Apr 22.27[a]	Jan 27+86=5+29+31+22=Apr 22
5	7 Cambyses	523	Jan. 2	179+16	July 16	"Phamenoth"	"1 hr. before midnight"	Jul 17.05[a]	Jan 2+195=29+28+31+30+31+30+16=July 16
6	20 Darius	503-2	Dec. 28	299+27	Nov 19	"Epiphi"	"1 1/4 hr. before midnight"	Nov 20.06[a]	Dec 28+326=3+31+28+31+30+31+30+31+31+30+31+19= Nov 19
7	31 Darius	491	Dec. 25	119+2	Apr 25	"Tybi"	"midst of 6th hour of night"	Apr 25.92	Dec 25+121=6+31+28+31+25=Apr 25
8	Archon Phanostratos	383-2	Nov. 28	179+23	June 18	"Phamenoth"	"8 1/4 hr. after noon of 24th"	June 18.87	Nov 28+202=2+31+31+28+31+30+31+18=June 18
9	55th of 2nd Callipic period	200	Oct. 13	329+5	Sept 12	"Mesore"	"2 1/3 civ. hr. after mid."	Sept 12.11	Oct 13+334=18+30+31+31+28+31+30+31+30+31+31+12= Sept 12
10	197th from Alexander	129-8	Sep. 25	209+10	May 2	"Pharmuthi"	"5 civ. hr. before noon 11th"	May 2.28	Sept 25+219=5+31+30+31+31+28+31+30+2=May 2
11	20 Hadrian	A.D. 135-6	Jul. 21	209+20	Mar 6	"Pharmuthi"	"4 hr. after midnight"	Mar 6.01	July 21+229=10+31+30+31+30+31+31+29+6=Mar 6
12	Sirius rose at Alexandria	139	July 21	Censorinus, "De Die Natali," tr. by Maude, p. 33. New York, 1900.					[a] Nos. 2, 5 and 6 run over into another day, because of the Guinness constants ("Idem, col.9).
13	Sirius rose	238	June 25						



* References on pages 6-10

[a] Guinness, Vol. II, p. xlviii

COMPUTATIONS EMPLOYED IN ANALOGUE TABLES I,II,III

1. Procedure in Computation of Egyptian Dates (Table I)

From Egyptian New Year Table (pp. 1,2), find Julian date for 1 Thoth of specified year. Determine interval from 1 Thoth to Egyptian date inclusive (col. 5), and add interval to civil date of 1 Thoth. Resultant figure is Julian equivalent in astronomical time (noon to noon) for the Egyptian date of papyrus, tablet or stone, as the case may be.

For example: In the year 465 B. C. (Papyrus "B"), the civil date for the Egyptian new year is Dec 18 (col. 4), corresponding to a noon-to-noon day. Interval from 1 Thoth to 17 Thoth (Papyrus date, col 5) is 16 days. Add 16 days to Dec 18 and get Jan 3 -- the Julian equivalent in astronomical time for 17 Thoth in year 465-464 B. C. To this date add one calendar day to reduce to Jewish civil time. Result is Jan 4, the coincident Aramaic date in Papyrus "B." (Comp. col. 16.)

2. Procedure in Computation of Jewish or Aramaic Dates (Table II)

From Jewish Passover Table (page 3), find Julian date for 1 Nisan of specified year, and note also length of year between passovers, as given in last column. (The length of the Jewish year determines the length of its variable months. If the year has an extra day, as in a 355-day year, that day is given to Ḥesvan; if the year is short one day, as in a 383-day year, a day is taken from Kisleu.) Determine interval from 1 Nisan to Aramaic papyrus date inclusive, and add to civil date of 1 Nisan. Resultant figure is the Julian equivalent, in Jerusalem civil time, of the Aramaic date.

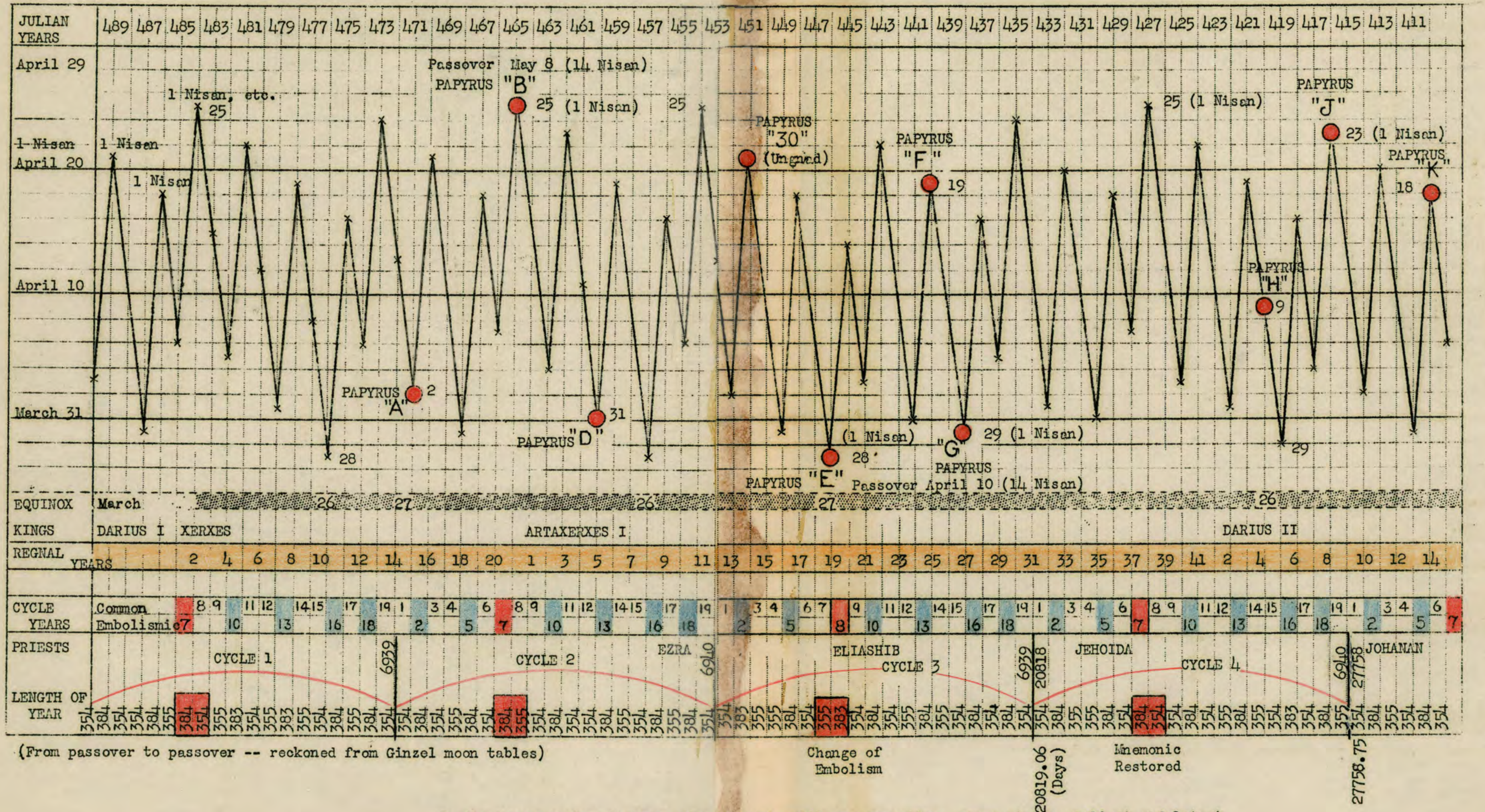
For example: In the year 465 (Papyrus "B"), 1 Nisan is dated Apr 25 (col. 12), and the length of year is 355 days (last column of Passover Table). Ḥesvan gets the extra day, and is therefore 30 days long, making the interval from 1 Nisan to 18 Kisleu, 254 days. Add 254 days to April 25 (5+31+30+31+31+30+31+30+31+4), and the result is Jan 4, the Julian civil date of 18 Kisleu. This whole computation is based on the simple fact that the ancient Jewish Passover followed the Jewish day of full moon in Jerusalem at the time of barley harvest.

It is always necessary to take note of the Julian leap years, when February has 29 days. If the year B. C., when divided by 4 has a remainder of 1, then it is a leap year. But, as in the case of the year 465, which had its leap day in early spring, the computation does not always pass over the leap month, and this fact has to be carefully watched.

3. Procedure in Computation of Ptolemaic Eclipses (Table III)

Each eclipse is worked out in connection with Table III, and discussed in detail on pages 11 to 19.

CONSTRUCTION OF ARAMAIC CALENDAR IN TIME OF EZRA AND NEHEMIAH
(Nisan Limits Marked by Assuan Papyri)*



(From passover to passover -- reckoned from Ginzel moon tables)

In the accompanying diagram, the papyri, with one exception, occur at the earliest and latest limits of 1 Nisan. By counting ahead to 14 Nisan, it may be noted that the passover limits in this century are from the date April 10 to May 8. (Cf. "E" and "B".) These limits are in harmony with those of the first century A.D., that Scaliger reports as April 8 to May 6 ("De Emendatione Temporum," p. 265), and which would of necessity be dated two days earlier, owing to the earlier occurrence of the moon one day every 300 years on the Julian calendar (Scaliger, "De Emendatione Temporum," p. 70). The papyri dates therefore confirm Scaliger's testimony, which he derived from early Jewish cycles he had in hand.

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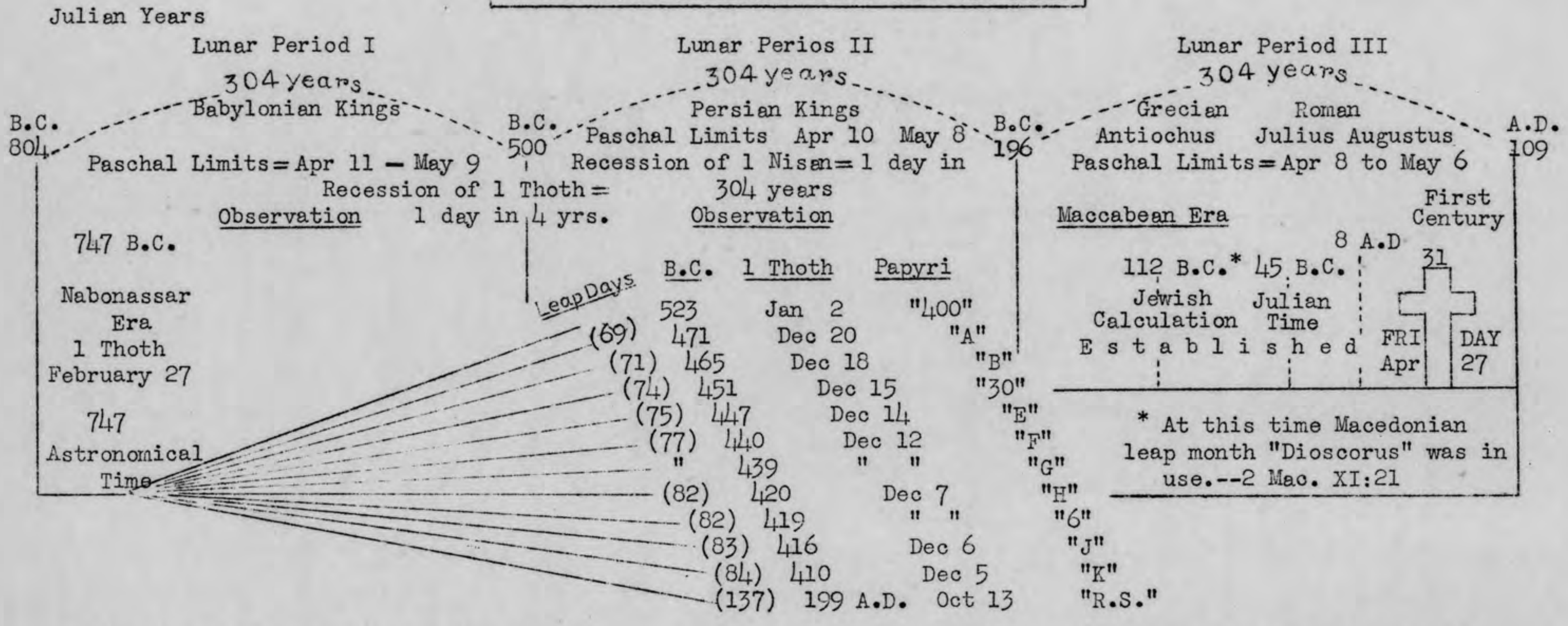
* Cowley, A.E., "Aramaic Papyri of the Fifth Century B.C.," p. 10, ff. Oxford, 1923.

RECESSION OF ARAMAIC AND EGYPTIAN NEW YEARS



Leap Days	B.C.	1 Thoth	Papyri
	523	Jan 2	"400"
(69)	471	Dec 20	"A"
(71)	465	Dec 18	"B"
(74)	451	Dec 15	"30"
(75)	447	Dec 14	"E"
(77)	440	Dec 12	"F"
"	439	" "	"G"
(82)	420	Dec 7	"H"
(82)	419	" "	"6"
(83)	416	Dec 6	"J"
(84)	410	Dec 5	"K"
(137)	199 A.D.	Oct 13	"R.S."

* At this time Macedonian leap month "Dioscorus" was in use.--2 Mac. XI:21

Each year in the accompanying diagram corresponds to a certain number of leap days, as reckoned from the beginning of the Nabonassar Era, February 27, 747 B.C. Inasmuch as 1 Thoth, the Egyptian new year, slips back one day every 4 years, the position of 1 Thoth for any year, will be just as many days earlier than February 27, as there are leap days in the interval between 747 and the selected year (of course in advance of the beginning of the era). The following series of months corresponds to the monthly position of 1 Thoth during the Sothic Cycle from 1322 B.C. to 139 A.D.:

B. C.	
1369 -- 1246	July
1249 -- 1126	June
1125 -- 1002	May
1001 -- 882	April
881 -- 759	March
758 -- 642	February
641 -- 518	January

B. C.	
517 -- 394	December
393 -- 274	November
273 -- 150	October
149 -- 30	September
A.D.	
29 -- 95	August
96 -- 219	July

PAPYRUS REFERENCES FOR ANALOGUE TABLE (PAGE 4)

(Translated by A. E. Cowley from original texts)

Papyrus "A" -- Grant of building rights. Date said to be quite certain, 471 B. C. Found rolled up, tied, and sealed.

Translation of Date: "On the 18th of Elul, that is the 28th day of Pahons, year 15 of King Xerxes, etc."--Cowley, A. E., "Aramaic Papyri of the Fifth Century B. C.," p. 11. Oxford, 1923.

Papyrus "B" -- Concerning property rights. Papyrus is almost perfect, but the number in the Egyptian month is broken. Gutesmann and Hontheim calculate "17" to be the required number. Fotheringham and Shürer -- and therefore Ginzel, who made all the calculations for Shürer --favor "17 Thoth" (Monthly Notices of the Royal Astronomical Society, Vol. LXIX, 1909, p. 14).

Translation of Date: "On the 18th of Chisleu, that is the 7th (17th, in harmony with foregoing) day of Thoth, in year 21, the beginning of the reign when King Artaxerxes sat on his throne, etc."--Idem, p. 16.

Papyrus "D" -- Translation of Date: "On the 21st of Chisleu, that is the 1st day of Mesore, the 6th year of Artaxerxes, the king, etc."-- Idem, p. 23.

Concerning this papyrus, Cowley reasons that Artaxerxes I is signified because the transaction relates to the same persons whose names appear in "B." But the 21st Kisleu as 1 Mesore would mean that 1 Thoth would have to occur a month earlier than its position in the 6th of Artaxerxes -- Dec. 16/17 for 460 B. C. -- and Fotheringham and Shürer solve the difficulty by making the Aramaic date read a month earlier, that is, as 21 Hesvan, instead of 21 Kisleu. With this reading, the synchronism is exact. See Fotheringham's "Calendar Dates," in Monthly Notices of the Royal Astronomical Society, Vol. LXIX, p. 15.

Papyrus "30" -- Ungnad No. "30" is the same as No. "10" in Cowley. Papyrus refers to a contract for a loan. Was a long document almost perfectly preserved, found still folded, tied and sealed.

Translation of Date: "On the 7th of Chisleu, that is the 4th day of the month Thoth, the 9th year of Artaxerxes the king, etc."--"Aramaic Papyri," p. 30.

The synchronization does not take place in the 9th of Artaxerxes, as reckoned from his first year in 464 B. C., but from the 9th year after the revolt of Egypt in 460 B. C., as soon as the Persians had again obtained control. The coincident year of the two dates is 451 B. C. Although the war, incited by the Libyan king Inaros, lasted six years (Thucydides, "History of the Peloponnesian War," Book 1, CVIII. 5-CX. 2. p. 183. Tr. Smith. Harvard Press, 1935), yet in a short time "the remnant of the Persians held out, and gave Artaxerxes time to send a new army to their aid" (Brugsch, Henry, "History of Egypt," Second Edition, p. 332. London, 1881). Dr. Brugsch quotes the text of a rock-inscription, in which the Persian eunuch Aliurta mentions his service under Artaxerxes as "the five years of the king of Upper and Lower Egypt, the sovereign, Arta-khshesesh (Artaxerxes), and the 16 years, etc." Evidently the Egyptian revolt in 460 B. C., resulted in the two periods of Aliurta's office (Idem, p. 314), and Papyrus "30" seems to confirm this short lapse of Persian rule.

Papyrus "E" -- Cowley says that "a peculiarity of this text is the number of mistakes in spelling, though the scribe, Nathan b. Ananiah, must have been a professional notary, since he also wrote Nos. 10 and 15."

Translation of Date: "On the 3rd of Chisleu, that is the 10th day of the month Mesore, year 19 of Artaxerxes the king, etc."-- "Aramaic Papyri," p. 38.

In Cowley's comment on this date, he says: "According to Gutesmann it should be Chisleu 2 = Mesore 10, or Chisleu 3 = Mesore 11. Hontheim reads 2."-- Idem. It would be easier to drop a figure out of the Aramaic text than to insert one. Hence we accept the alternative reading, "Chisleu 2 = Mesore 10."

Papyrus "F" -- Settlement of claim. Date is 441-440 B. C.

Translation of Date: "On the 14th of Ab, that is the 19th day of Pahons, year 25 of Artaxerxes the king, etc."-- Idem, p. 42. "The papyrus is in an excellent state of preservation."

Papyrus "G" -- Marriage contract. "About 441 B. C." Text shows that the number of the king's year is lost, for the first line is much broken. Cowley says that the text is very difficult, "partly owing to its broken condition, and partly to the many unknown words." Owing to the age of the sons, "present marriage cannot have taken place much after 440." Synchronization does occur in 439 B. C. for 23rd of Tisri. The date for Tisri is uncertain.

Translation of Date: "On the 25th (?) of Tisri that is the 6th day of the month Epiphi, year. . . of Artaxerxes the king, etc."-- Idem, p. 45.

Papyrus "H" -- Settlement of a claim. 420 B. C. "The date is the 4th year of Darius, who must be Darius II, and the year is therefore 420 B. C."

Translation of Date: "In the month Elul, that is Payni, 4th year of Darius the king at that time in Yeb the fortress, etc."-- Idem, p. 58.

Cowley's comment: "The day of the month is not given, which is unusual. The Egyptian month may be Payni or Paophi. From the calculations of Mr. Knobel and Dr. Fotheringham, it seems that Payni suits the chronology best. So also Gutesmann."-- Idem, p. 59.

Since Elul has 29 days, and Payni, 30, the coincidence would have to occur either at the beginning or end of the month. In 420, it occurred at the end of Elul and Payni.

Papyrus "J" -- Renunciation of claim. "The date, which is given twice, is the 8th (Egyptian 9th) year of Darius (II) = 416 B. C."-- Idem, p. 83. Cowley further comments on the date, saying that "the Egyptian year began with Thoth, and did not coincide with the Jewish year beginning with Nisan. This synchronism is important." Idem.

Translation of Date: "On the 3rd of Chisleu, year 8, that is the 12th day of Thoth, year 9 of Darius the king at that date in Yeb the fortress, etc."-- Idem, p. 85.

Papyrus "K" -- Assignment of slaves. Papyrus very well preserved, and "hardly any letter really doubtful." Cowley emphasizes the double reckoning of the regnal years, that counts 13 Jewish and 14 Egyptian for Darius II in Shebat and Athyr in 412-411 B. C. (Idem, p. 103.)

Translation of Date: "On the 24th of Shebat, year 13, that is the 9th day of Athyr, year 14 of Darius the king in the fortress of Yeb, etc."-- Idem, p. 104.

Stone "R. S." -- Rosetta Stone. Ptolemy Epiphanes -- the fifth Ptolemy -- is the king of the Rosetta Stone (Mahaffy, J. P., "Flinders Petri Papyri," p. 27, note. Dublin, 1891), and the inscription "was certainly decreed in the 9th year of his reign" (Mahaffy, "History of Egypt," p. 151). But when Philopator died, young Ptolemy Epiphanes (5 years old) had already been co-regent from the year of his birth (Smyley, J. Gilbart, "Greek Papyri from Gurob," p. 28. Dublin, 1921; Mahaffy, "History of Egypt," p. 151). He was only later crowned at Memphis "in the 9th year of his reign" (Revillout, E, "Papyrus Bilingue du temps de Philopator," p. 42. London, 1892). His 9th year was doubtless taken to be the 9th of his co-regency, and hence of his birth year, for it is in 199 B. C. that the Rosetta Stone dates synchronize. Dr. Smyley argues (loco citato) that Epiphanes was born in 210 B. C., and was made co-regent 50 days after birth. On the basis of this history, the Rosetta Decree harmonizes with 199 B. C.

Translation of the Rosetta Inscription Date: "In the 9th year. . . of the god Epiphanes Eucharistos. . . the 4th of the month Xanthicus, according to the Egyptians the 18th of Mecheir."-- Mahaffy, J. P., "History of Egypt," p. 152. London, 1899. See also Mülleri, C and T., "Fragmenta Historicorum Graecorum, Inscription de Rosette." Tr. by Latronne. Paris, 1853.

ECLIPSE REFERENCES FOR TABLE (PAGE 4)

(Translated from Ptolemy's Greek text)

1. "Therefore, of three ancient eclipses of those observed in Babylon, which we have taken, the first is recorded in the first year of Mardokempad, on the 29/30 of the Egyptian Thoth. The eclipse began, they say, fully an hour after the rising, and it was total. Since the sun stood in the last of the Fishes, the night had properly 12 equinoctial hours exactly, and so the beginning of the eclipse of course fell 4 1/2 equinoctial hours before midnight, but the middle, when now the eclipse was full, 2 1/2 hours before midnight. . . but in Alexandria we found the middle of the submitted eclipse 3 1/3 equinoctial hours before midnight."--Claudiou Ptolemaiou, "Mathematikē Suntaxis," pp. 244, 245. In Halma. Paris, 1813. [721 B. C., Mar 19.]

2. "And the second eclipse was recorded in the second year of the same Mardokempad on the 18/19 of the Egyptian Thoth. . . the middle of the eclipse occurred in Babylon at the middle of the night itself, but in Alexandria it appeared at 5/6 of an hour before midnight."-- Idem, p. 245. [720 B. C., Mar 8]

3. "And the third eclipse was recorded in the second year of Mardokempad, on the 15/16 of the Egyptian Phamenoth. . . In Alexandria the middle of the time of the eclipse was complete at 4 1/3 equinoctial hours before midnight."-- Idem, pp. 245, 246. [720 B. C., Sept 1.]

4. "For in the 5th year of Nabopollassar, which is the 127th year of Nabonassar, on the 27/28 Egyptian Athyr, toward the end of the 11th hour, in Babylon the moon began to eclipse, and for the most part a quarter of the diameter was obscured on the south. . . in Alexandria it (the middle of the eclipse) occurred only 5 hours after midnight."-- Idem, pp. 340, 341. [621 B. C., April 22.]

5. "Again in the 7th year of Cambyses, which is the 225th year from Nabonassar, according to the Egyptian 17/18 Phamenoth, one hour before midnight, the moon was eclipsed in Babylon on the northern half of its diameter. . . in Alexandria it occurred 1 5/6 equinoctial hours before midnight."-- Idem, pp. 341, 342. [523 B. C., July 16.]

6. "The second eclipse employed by Hipparchus, occurred in the 20th year of Darius, the successor to Cambyses, in the 28/29 of the Egyptian Epiphi, the night having advanced 6 1/3 equinoctial hours, in which the moon, in like manner, eclipsed the fourth part of its diameter on the south. . . in Alexandria the middle of the eclipse occurred 1 1/4 equinoctial hours before midnight."-- Idem, pp. 269, 270. [502 B. C., Nov. 19.]

7. "As the first eclipse, we have named that one which, under Darius I in Babylon, in the 31st year of his reign, was observed on the 3/4 Egyptian Tybi, in the midst of the 6th hour of the night. At the same time, as the exact report runs, the moon was eclipsed two inches on the south, that is, 1/6 part of its diameter."-- Idem, p. 267. [491 B. C., April 25.]

8. "Again, they say that the eclipse occurred when Phanostratos the Athenian was archon, in the month Skirophorion, on the 24/25 Egyptian Phamenoth. . . Now the sun stood in the last part of the Gemini, thus the hour of the night amounted to 12 time-degrees, that is, 48^m; consequently made 5 1/2 civil hours, or 4 2/5 equinoctial hours. The beginning of the eclipse had therefore taken place 4 2/5 hours before midnight, or 7 3/5 equinoctial hours after the noon of the 24th; but since the whole length of the eclipse was given at 3 hours, thus the middle was evidently 9 1/10 equinoctial hours after the noon. In Alexandria, consequently, it must have entered 8 1/4 equinoctial hours after noon of the 24th."-- Idem, pp. 276, 277. [382 B. C., June 18.]

9. "They say that the third eclipse occurred in the 55th year of the second period on the 5th Egyptian Mesore. . . Now since the sun stood in the midst of the Virgin, thus in Alexandria, the hour of the night amounted to 14 2/5 time-degrees, that is 57 $3/5^m$; consequently made out the 2 1/3 civil hours after midnight, or 2 1/4 equinoctial. Therefore the middle (of eclipse) was 14 1/4 equinoctial hours after the noon of the 5th."-- Idem, p. 281. [200 B. C., Sept 12.]

10. "Hipparch asserts that he observed the sun and moon with the help of instruments in Rhodes on the 11th of the Egyptian Pharmuthi, at the beginning of the second hour -- 197th year after the death of Alexander. . . Now if the observation took place at the beginning of the second hour, that is, about 5 civil hours before the noon of the 11th, etc."-- Idem, p. 300. [128 B. C., May 2.]

11. "The third eclipse had occurred in the 20th year of Hadrian, on the 19/20 of the Egyptian Pharmuthi. The middle, according to our reckoning, entered at 4 equinoctial hours after midnight."-- Idem, p. 255. [136 A. D., Mar 6.]

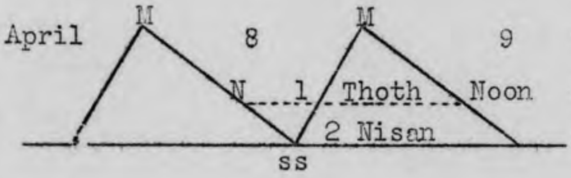
CORRESPONDING OPPOLZER REFERENCES
(Greenwich Civil Time)

1. Von Oppolzer, Th. Ritter, "Canon der Finsternisse," Wien, 1887.
No. 741, p. 332 = Mar 19. $19^h\ 4^m$. 721 B. C.
2. Idem. No. 743, p. 332 = Mar 8. $21^h\ 30^m$. 720 B. C.
3. Idem. No. 744, p. 332 = Sept 1. $17^h\ 4^m$. 720 B. C.
4. Idem. No. 901, p. 334 = April 22. $2^h\ 38^m$. 621 B. C.
5. Idem. No. 1056, p. 335 = July 16. $21^h\ 0^m$. 523 B. C.
6. Idem. No. 1090, p. 335 = Nov 19. $21^h\ 24^m$. 502 B. C.
7. Idem. No. 1107, p. 336 = April 25. $19^h\ 55^m$. 491 B. C.
8. Idem. No. 1276, p. 337 = June 18. $18^h\ 31^m$. 382 B. C.
9. Idem. No. 1547, p. 340 = Sept 12. $0^h\ 28^m$. 200 B. C.
10. Idem. No. 1660, p. 341 = May 2. $4^h\ 35^m$. 128 B. C.
11. Idem. No. 2075, p. 345 = Mar 6. $1^h\ 43^m$. 136 A. D.

THE PROBLEM.--In order to understand the meaning of the ancient Egyptian and Aramaic double dates, found on papyrus, tablet, and stone, it is essential first of all (1) to demonstrate the relation between the three calendars involved -- Egyptian, Jewish, and Julian. Although Julian time did not exist before the age of the Caesars, yet all the chronological tables and eclipse canons which extend back to ancient periods of history are based upon a projected Julian year. The Julian calendar is therefore definitely related to the solution of this problem, and becomes the common denominator of time between the other two. A second feature (2) concerns the synthetic construction of suitable calendar tables, upon which the papyri dates can be oriented, and their epochs demonstrated.

1. Relation Between the Calendars.--According to both tradition and authoritative chronology, the Egyptian day was astronomical, and probably extended from noon to noon. It was doubtless the forerunner of the nautical astronomical day, which was in operation until 1925. Tradition has it that the Egyptian day began when the hour angle of the sun was zero, that is, when the sun crossed the meridian. The Egyptian new year day, 1 Thoth, started at noon, and, according to Albîrûnî, the day was reckoned from the moment "when the sun arrives on the plane of the meridian, till the same moment of the following day." ("Chronology of Ancient Nations," p. 6.) The day was designated by one single date, though it passed through the midnight hour. Anciently, people were induced to prefer the meridian to the horizon, because the day from sunset to sunset varies in length, while the time between meridians is constant, and regular everywhere on earth. The horizons, on the other hand, vary for every latitude. The Jewish day, on the contrary, consists of parts of two days; but on the calendar, it is customary to civil-date the Jewish day by the Julian day with which it coincides from midnight to sunset. This is the second civil day of the two with which the Jewish year agrees.

While chronologers are not unanimous in their opinion concerning the Egyptian day, as from noon to noon, yet this plan is in harmony with a reasonable solution of the papyri double dates. The following diagram further demonstrates the exact relation between Egyptian and Jewish time:



= Civil Time (midnight to midnight)
= Egyptian " (noon to noon)
= Jewish " (sunset to sunset)

Therefore 2 Nisan (April 9, civ. time) = ~~5 Athyr~~ 1 Thoth (April 8, astronom. time) --on the calendar, one day difference.

In this diagram, the Egyptian day, 1 Thoth, starts at noon, and is calendar-dated April 8 until the subsequent noon. It takes the date of the civil day in progress "one moment after the noon" at which it begins. The Jewish day, 1 Nisan, starts at sunset of April 8 and extends to sunset of April 9. While it covers parts of two days, April 8 and April 9, on the calendar, it is designated April 9 only. Although both Jewish and Egyptian days have apparently 18 hours in common, yet, on the calendar, the Jewish day is dated one day later than the Egyptian. There is consequently one day's difference between these two days in their calendar dating. This is the first feature of the papyrus problem to be understood.

2. The Tables.--The second feature relates to the preparation of Jewish and Egyptian calendar tables, which will outline the two kinds of time involved--civil and astronomical. The Jewish Table, found on page 3, is based on the two crucifixion postulates: (a) The passover moon in time of barley harvest; and (b) the passover on the day following Jewish full-moon-day in Jerusalem. The Ginzel full moon dates (G.M.T.) were used in determining the true passover dates, and were first changed to Jerusalem civil time by adding $12^h + 2^h\ 20^m (0^d.59)$ to each full moon. Those full moon Julian dates that then came before sunset were designated 13 Nisan, and those civil dates that occurred after sunset, were designated 12 Nisan. 14 Nisan was then counted

as the day following Jewish full moon day in Jerusalem, and the 1st day of Nisan was reckoned as the 14th day earlier. Each translation period was computed as the difference between conjunction and 1 Nisan, 6 o'clock sunset. Length of year was calculated from one passover to another, using the Julian calendar. If year was 354 days long, the months alternated a regular sequence of 30 and 29 days, from Nisan to end of year. If year was 355 days, Hesvan was made 30 days; if 383 days, Kisleu was given 29 days. In leap year, Adar had 30, and Veadar, 29. Barley harvest moons determined whether year was common or embolismic. (For Table of Jewish and Egyptian months, cf. page 19.)

The Egyptian New Year Table (pp. 1,2) is based upon months, each one of which had 30 days, except 12th month Mesore, which had 35. The Egyptian year was therefore only 365 days long, and never changed. Its new year, 1 Thoth, slipped back one day every four years, and continued for the 4-year period. (Comp. Table V for 1 Thoth months from Nabonassar era to end of Sothic cycle.) The 1 Thoth dates of the Table (pp. 1,2) are founded upon 15 or more Ptolemaic lunar eclipses (Table III, p. 4), upon coincident Julian eclipse dates from Oppolzer's Canon, and upon the corresponding full moon dates from the Ginzel and Guinness tables (Table III, p. 4, col. 8). In the "Almagest" references (pp. 9, 10), are the translations from Ptolemy's Greek text, giving the exact position of each eclipse, first in Babylon, and then in Alexandria. From these direct quotations, it will be noted that the descriptions are not given in astronomical time, in connection with the Egyptian date, but are directly related to a single point of time -- either midnight, noon, or Babylonian sunset. However, Ptolemy usually concludes with an Alexandrian dating of each eclipse. And when the Alexandrian dates are compared with Oppolzer's Greenwich civil time eclipses, they are found in almost exact agreement. Frequently Ptolemy mentions the eclipse as between two Egyptian dates; sometimes only one date is given; and then again the eclipse may occur on his second date, as is the case with No. 11, of the series here presented.

From these canons and tables, it is possible to establish the exact position of each Ptolemaic eclipse, its coincident Julian date, full moon date, and Egyptian date. (All these details are diagramed in columns 6, 7, and 8 of Table III, p. 4, and the eclipse references are pp. 9, 10.) But first, from Table V, p. 5-a, find the civil month that corresponds to 1 Thoth for the regnal year selected, as for example, 720 B. C., in eclipse No. 3. In this instance, 1 Thoth was in February. The statistics for eclipse No. 3 in 720 B. C., with 1 Thoth in February point to September --193 days later-- as the time of the eclipse. For September, 720 B. C., Oppolzer gives Sept. 1 $17^h\ 4^m$ ("Canon," No. 744, p. 332.) The equation therefore becomes possible that --

> September 1 $17^h\ 4^m + 2^h\ 10^m$ (Oppolzer's eclipse in Alexandrian time) $=$ "4 1/3 hours before midnight," 15 Phamenoth (Ptolemy's eclipse for Alexandria.)

. In this equation, both Ptolemy and Oppolzer are in practical agreement in civil-dating the eclipse. Oppolzer's "$19^h\ 14^m$" (Alex.C.T.) was 7:14 p.m.; Ptolemy's "4 1/3 hours before midnight" was 7:40 p.m. Hence, both dates must be treated as civil time. The important feature only is to determine which Egyptian date ends the interval, that extends back to the true date of 1 Thoth. In the diagram (Table III, column 6), the day ending each interval is stippled. In No.1 instance, the eclipse position adds a part of a day to the interval. If this interval is less than 12 hours, as when eclipse occurs before midnight, it can not be designated as a whole day on the calendar without breaking the correlation of the calendars, and the two kinds of time involved. If the interval is <u>more</u> than 12 hours, as is the case when the eclipse occurs <u>after</u> midnight, then the Egyptian day of the eclipse is the end of the interval, as in Nos. 4, 9, 10, and 11.

For example: In No. 9, 200 B. C., according to the testimony of Ptolemy, we may look for an eclipse <u>on</u> 5 Mesore, "2 1/3 hours after midnight," which would be 334 days after 1 Thoth. In 200 B. C., 1 Thoth occurred 137 days earlier than in February, 747, (cf. leap-day Table V, p.5-a) or about the middle of October; 334 days later than this point of Time, point to September for the eclipse. Oppolzer's Canon, No. 1547, p. 340, records just one lunar eclipse in the autumn of 200 B. C.--September 12 $0^h\ 28^m$. The equation, therefore, can be written that --

September12 $0^h\ 28^m + 2^h\ 10^m$ (Oppolzer's eclipse in Alexandrian civil time) $=$
"2 1/3 hours after midnight," 5 Mesore (Ptolemy's eclipse for Alexandria)

Oppolzer's date is 2:38 a.m., and Ptolemy's, 2:20 a.m. They are therefore both in civil time. To this eclipse and to one more of the series in Table III (No. 10), Ptolemy ascribes a single Egyptian date. This helps much in discovering the Julian date that corresponds to his beginning of the Nabonassar era. In No. 9, he counts the interval from the beginning of the "epoch" as 547 years, 334 days, and 14¼ hours ("Mathematikē Suntaxis," p. 281). These figures plainly declare that he was reckoning as if from February 27 as 1 Thoth in 747 B. C., which the following calendric argument shows:

If February 27 was 1 Thoth in 747 B. C., as the Egyptian New Year Table represents, then in 200 B. C., the new year would have receded 137 days to October 13, as given on page 2 of the Table. Ptolemy counted 5 Mesore -- the day of the eclipse -- as the 335th day of the year, which is the equivalent of 1 Thoth + 334 days. By adding 334 days to 1 Thoth, or October 13 (18+30+31+31+28+31+30+31+30+31+31+12), we get Sept. 12 as the result, which is Oppolzer's date for the eclipse.

Consequently, the 5th Mesore must be the end of the interval, and 1 Thoth is found by reckoning back 334 days from Sept. 12, thus making October 13 to be civil date for 1 Thoth in 200 B. C., and February 27 in 747 B. C. In column 9, the reckoning is reversed, adding 334 days to October 13, thus marking September 12 as the civil date of the eclipse. The ruling is therefore important that when the eclipse occurs after midnight, the Egyptian day in progress at that time is the end of the interval. Eclipse No. 10 Ptolemy also computes in the same way ("Idem," p. 300). Both eclipses are important witnesses for making February 27 the beginning of the Nabonassar era.

No. 11 offers a slight variation from the others, in that the eclipse occurs on the second Egyptian date mentioned by Ptolemy, that is, 20 Pharmuthi. But this position is established by the testimony of Censorinus, requiring July 21 ("12th of the calends of August") as 1 Thoth in the 4-year period from 136 to 139 A. D. His statement follows:

> "The aeras of the Egyptians always commence on the first day of the month, Thoth, a day which, this present year, corresponds to the 7th calends of July, whilst a hundred years ago [139 A. D.], under the second consulate of the Emperor Antoninus Pius and of Bruttius Praesena, this same day corresponded to the 12th of the calends of August, the ordinary epoch of the rising of the Canicular star in Egypt. Thus we see that we are to-day really in the hundredth year of the Annus Magnus, which, as I have stated above, is called the solar and canicular year and Year of God."--"De Die Natali," tr. by Maude, p. 33. New York, 1900.

On the basis, therefore, of these well-authenticated Ptolemaic eclipses, eleven of which are given in Table III, and of the corresponding Oppolzer Canon eclipse dates in Julian time, the Egyptian New Year Table, is here offered with which to solve the double dating of papyrus, tablet and stone. 1 Thoth being established for the eclipse years, it was then possible to compute 1 Thoth for the intervening years, by simply making it one day earlier every fourth year. In this manner, the New Year Table was built up. When Egyptian dates are computed according to the position of 1 Thoth, as given in the Table for the various 4-year periods, the resulting dates will occur earlier by one day than their companion Aramaic dates, the one being given in astronomical time, and the Aramaic in civil time. (Comp. Tables I and II, cols. 7 and 16, p. 4). This difference of one day was demonstrated to have existed between ancient Egyptian and Jewish calendation. The synthetic tables here presented for the solution of this calendar problem -- the Jewish, based upon the two important principles governing the crucifixion date, and the Egyptian, definitely tied to two authentic canons of eclipses -- similarly differ by one day in their resultant computed dates.

With the exception of Papyrus "E," which investigators of this problem recognize to be an extra day out of alignment, the other eleven monument dates have this constant difference of one day. If the tables of Schram, Ginzel or P. V. Neugebauer, should be substituted, the results would differ. Ginzel starts his Nabonassar era with February 27, the same as the Table here presents, but some of his 1 Thoth dates are out of agreement with important eclipses. However, when he comes to the year 139 A. D., he places the rising of Sirius on July 21 ("Handbuch der mathematischen und technischen Chronologie," p. 187. Leipzig, p. 1906). This is in harmony with Censorinus, and with the eclipse in 136 A. D., March 6, the 20th year of Hadrian. In commenting on the relation of Egyptian and Julian calendars, the following remark comes from Glenn Draper, Associate Astronomer, U. S. Naval Observatory:

> "If one were privileged to tell early chronologers how to have dated their events in different calendars, the rule of correspondence should be, the day in progress one moment after noon. As it is, their confusion has come on down to modern times."--Glenn Draper, Washington, D. C., September 20, 1940.

Dr. O. Neugebauer, professor of mathematics in Brown University, finds the Egyptian dates in Schram and Ginzel too early to agree with a dated motion of the five major planets. He was therefore interested in the Egyptian Table here presented, that begins the Nabonassar era with February 27.

The principles of calendation employed in the construction and use of the Jewish Table (page 3), have been briefly outlined in the beginning of this discussion. It should be further stressed, however, that the small constant difference between the resultant Egyptian and Aramaic dates is of great importance in support of the calendar features that characterize the Jewish Table. The Egyptian calendar has no variations whatsoever; its months are each 30 days long, and five days are always added at the end of every year. The Jewish calendar is just the opposite -- varying all the time outside of its fixed feast period of seven months. Consequently, this constant difference of one day between the two systems of time reckoning -- a large portion of which is a permanent calendar arrangement that never changes -- shows that the last five months of the Jewish year, although subject to regular, repetitive change, are nevertheless balanced by the moon's motion. It is therefore these variable calendar months that exhibit this uniform difference between two very dissimilar methods of time calculation. Such is the paradox existing between Jewish computations and the Egyptian Sothic Cycle.

The Cycle Table (page 5) is a rearrangement of the very revealing Wood 19-year cycles. Instead of conjunction dates, 1 Nisan dates have been substituted in laying out the calendar curve. This enables the passover limits to be demonstrated for the papyrus period. Papyrus "B" and Papyrus "E" point to April 10 and May 8, respectively, as the extreme dates for the passover. These limits are in harmony with those of Scaliger for the first century, April 8 to May 6, which are necessarily two days earlier at the end of a 600-year period of Julian time.

The irregular intercalation presented by Papyrus "E," which demands embolism in year 8 of Cycle 3 instead of year 7, has been a source of much comment by various scholars. Fotheringham says that irregular intercalation was a definite characteristic of the ancient Babylonian cycle. ("Monthly Notices of the Royal Astronomical Society," Vol. LXIX, p. 18). Yet he does not consider the papyri cycles Babylonian. He quotes Shürer as concluding that in the papyrus period, the intercalations "were determined on principles similar to those which guided the Sanhedrin at a later date when the weather and the state of the crops were considered as well as the course of the sun."--Idem. M. Oppert has also proved, by his contract tablets, that the intercalations of the Babylonian calendar were irregular. ("La fixation exacte de la chronologie des derniers rois de Babylone," Zeitschrift für Assyriologie, 1893, pp. 56-74). Consequently, the change in embolism in Papyrus "E," which represents the Jewish calendar, would seem to indicate that observation was governing the passover date, rather than a fixed mnemonic. The fact that the papyri dates keep 1 Nisan away from the equinox, that is, they do not place 1 Nisan on or before it, is also evidence of observation only, in the papyrus period. Calculation was introduced in the Maccabean era, about 112 B. C. (Albîrûnî, "Chronology of Ancient Nations," Tr. by Sachau, p. 68). The Macedonian leap month "Dioscorus," was also in use in Syria at this time (2Mac. XI:21).

In 45 B. C., the Julian calendar reform was initiated, and the finishing touches were added by Augustus, in 8 A. D. Thus the way was prepared for efficient calendar reckoning in the time of Christ, based upon both observation and calculation.

ANCIENT CALENDAR MONTHS

Egyptian		Hebrew			Macedonian
Thoth	30	Nisan	30		Xanthicus
Paophi	"	Iyar	29		Artemisius
Athyr	"	Sivan	30		Daesius
Choiak	"	Tammuz	29		Panemus
Tybi	"	Ab	30		Löus
Mechir	"	Elul	29		Gorpiaeus
Phamenoth	"	Tisri	30		Hyperberetaeus
Pharmuthi	"	Ḥesvan	29	(30)	Dius
Pachons	"	Kisleu	30	(29)	Apellaeus
Payni	"	Tebeth	29		Audynaeus
Epiphi	"	Shebat	30		Peritius
Mesore	35	Adar	29	(30)	Dystrus
		Veadar	29		Dioscorus

Macedonian months are considered commensurate with the Hebrew. This is asserted by Josephus, Scaliger, Brown and other chronologers.

CONCLUSIONS

The foregoing pages represent the synchronization of double-dated monuments -- papyrus, tablet and stone -- belonging to the ancient Persian period in the age of Ezra and Nehemiah. The problem necessitated the construction of calendar tables for both Egyptian and Jewish reckoning, according to which these historic dates could be computed. The use of these tables involved particular and exact specifications relating to calendation in these two kinds of time. The final solution of this calendar question has given assurance of the certainty and soundness of the principles herein employed. By the eclipse calculations, Ptolemy, Oppolzer, and the Egyptian Table of 1 Thoth dates agree. It is revealing to list the various features of the calendric outline, according to which the synchronization was made. The series pertaining to the two calendars -- Egyptian and Jewish -- follow the conclusions here offered:

1. The Egyptian New Year Table of 1 Thoth dates -- constructed on the basis of Ptolemy's catalog of eclipses, and of Oppolzer's "Canon der Finsternisse"-- is thereby able to certify computations made according to its 1 Thoth positions, which cover a period of 1600 years.

2. The Jewish Table -- built up upon the two crucifixion postulates, involving all the principles of calculation employed in the solution of the crucifixion date, and of the 1844 event of prophecy -- offers a specific method of Mosaic reckoning, which, by virtue of its coincidence with the ancient Egyptian system, is therefore attested by the supporting canons of the Egyptian calendar.

3. The constant, resultant one-day difference obtained in the computed dates, determined by the use of these two calendar Tables, is indicative of the certainty and precision of the calendar rules applied.

4. The fact that the calendric principles governing the crucifixion date, solved also the papyrus dates, and provided an independent calculation confirming the Millerite 1844 chronology, shows that all three epochs of prophecy are controlled by one and the same luni-solar system of calculation.

The following calendric series was employed in the solution of the problem --

1. <u>Jewish Calendation</u>

   (a) Jewish day calendar-dated by its second civil date.
   (b) Passover following Jewish full moon day in Jerusalem.
   (c) Passover limits (April 8 to May 6, 1st century) determined by barley harvest moons.
   (d) Length of Jewish year -- from passover to passover.

(e) Jewish feast period (Nisan to Tisri) -- an alternate sequence of 30- and 29-day months.
(f) Ḥesvan = 30 days in 355-day year; Kisleu = 29 days in 383-day year; in leap year, Adar = 30 days, and Veadar, 29 days.
(g) Translation period = 1 to 4 days.
(h) Leap months determined by moon's place on the calendar.
(i) The 19-year cycle curve of the papyrus dates demonstrate the passover limits for the fifth century B. C. (April 10 to May 8).

2. <u>Egyptian Calendation</u> (used in this problem)

(a) Egyptian year was only 365 days long, and consequently receded through all the seasons in 1460 years.
(b) Egyptian day, from noon to noon, designated by one single civil date.
(c) Egyptian day calendar-dated by the civil day that is in progress "one moment after its first noon."
(d) Date of the Egyptian New Year recedes one day every 4th year, and continues as new year date throughout the 4-year interim.
(e) Egyptian New Year -- 1 Thoth -- continues in the same Julian month for about 120 years, according to length of Julian month.
(f) Nabonassar Era began at noon, February 27, 747 B. C.

These double-dated Aramaic papyri were rolled up, tied, and sealed nearly 2500 years ago. In 1900, or thereabouts, these seals were broken for the first time. They therefore present an undistorted picture of the age in which the papyri were written. Many calendar tables, cycles, and various solar and lunar constants have been tried out in the effort to harmonize these dates. But the synchronization is accomplished by the application of the two crucifixion postulates, which revive the Mosaic order of time, bring harmony and symmetry to primitive calendation, and unity and certainty to the understanding of the prophetic period under study.

<u>Grace E. Amadon</u>.

Insert after poem

Here ~~Bede~~ is synchronized the month of April with the time when the sun is in Aries, which is in complete harmony with Josephus' statement when he speaks of the month~~'s~~ as beginning in Aries and not necessarily the passover~~'s~~ ~~beginning~~ as occurring in that sign.

In a very critical study of the Papyri which are double dated as shown on page 17, the corresponding Julian equivalents were computed for both the Egyptian and Aramaic dates. The synchronisms as shown in the last column on page 17, --"Synchronisms"-- become more remarkable for the following reasons:

(1) The Egyptian dates are based on a calendar whose 365 day measuring stick required a new year's date which wandered back through the months making constant reference to some known starting point absolutely imperative. It is a calendar containing five blank days that must be taken into account and yet given no names.

(2) The Aramaic calendar on the other hand is a lunar system of reckoning requiring a year capable of having four different lengths -- 354, 355, 383, or 384 days -- thus making possible a great variation of the interval from the first day of Nisan to the date given in any papyrus. It is a calendar impossible of proper analysis unless the correct mnemonic determining the right embolysmic year be used. By the use of hypothesis "I", which requires such a mnemonic to be used as will cause the passover to fall in the time of the barley harvest, and by the use of hypothesis "II", which places the passover on the day following the full moon, the exact Julian date of Nisan 1 is determined and ~~thus allows~~ the moon itself is allowed to determine the proper length of any year. The year-length from 500 B. C. to 400 B. C. -- as shown in Table I -- has been ~~determined~~ computed from the positions of the moon as ~~given in~~ given from Ginzel's tables. The exact length of the year having been found, the interval from Nisan 1 to the given ~~Aramaic~~ papyrus date is determined by the use of Table II. This increment added to the computed date for Nisan 1 gives the Julian equivalent for the Aramaic date under discussion. (turn to middle of page 18 -- "Four of the eight Papyri . . .")

Hypothesis 1 -- The luni-solar year was intercalated in such a way as to bring the Passover in the time of barley harvest, April 7 to May 7, in the district of the Near East.

Chart A, page 7, shows a plot of the new moons or conjunctions of March and April from 455 B. C. to 402 B. C. as given in Ginzel's tables.[1] It is well known that a lunar year consists usually of twelve lunar months of 29.5 days each. This lunar year is approximately eleven days shorter than the ~~tropical~~ solar year of 365 1/4 days and this is shown on Chart A. For example, in 443 B. C., the new moons as shown on the chart fall on March 21.27, and on April 19.69, whereas a year later the conjunction occurs March 10.53 and April 9.12. In order to keep the first day of the new year in the same season from an agricultural standpoint, there was introduced very early into the calendars of the Semitic races an intercalary month every two or three years, whereby the year would contain thirteen lunar months instead of twelve, making the year 383 or 384 days long.

They also found that at the end of nineteen years the moon and the sun returned to a place in the heavens that was almost exactly the same as that occupied at the beginning of the nineteen-year period. By introducing seven intercalary months in this nineteen-year period, they came to the place where they were able to predict with great accuracy the exact position of the moon with regard to the sun. Let us say, for example, that we wish to so adjust the calendar that the first conjunction of the new year will always fall between the 21st of March and the 20th of April.

Begin with the point "a", Chart A, 443 B. C., we would have a conjunction April 19.69. These figures are taken from Ginzel's tables.[2] Then in 442 the conjunction marking the beginning of the new year would be at "b" on April 9.12 and the following year at "c" March 28.85. If it were to extend

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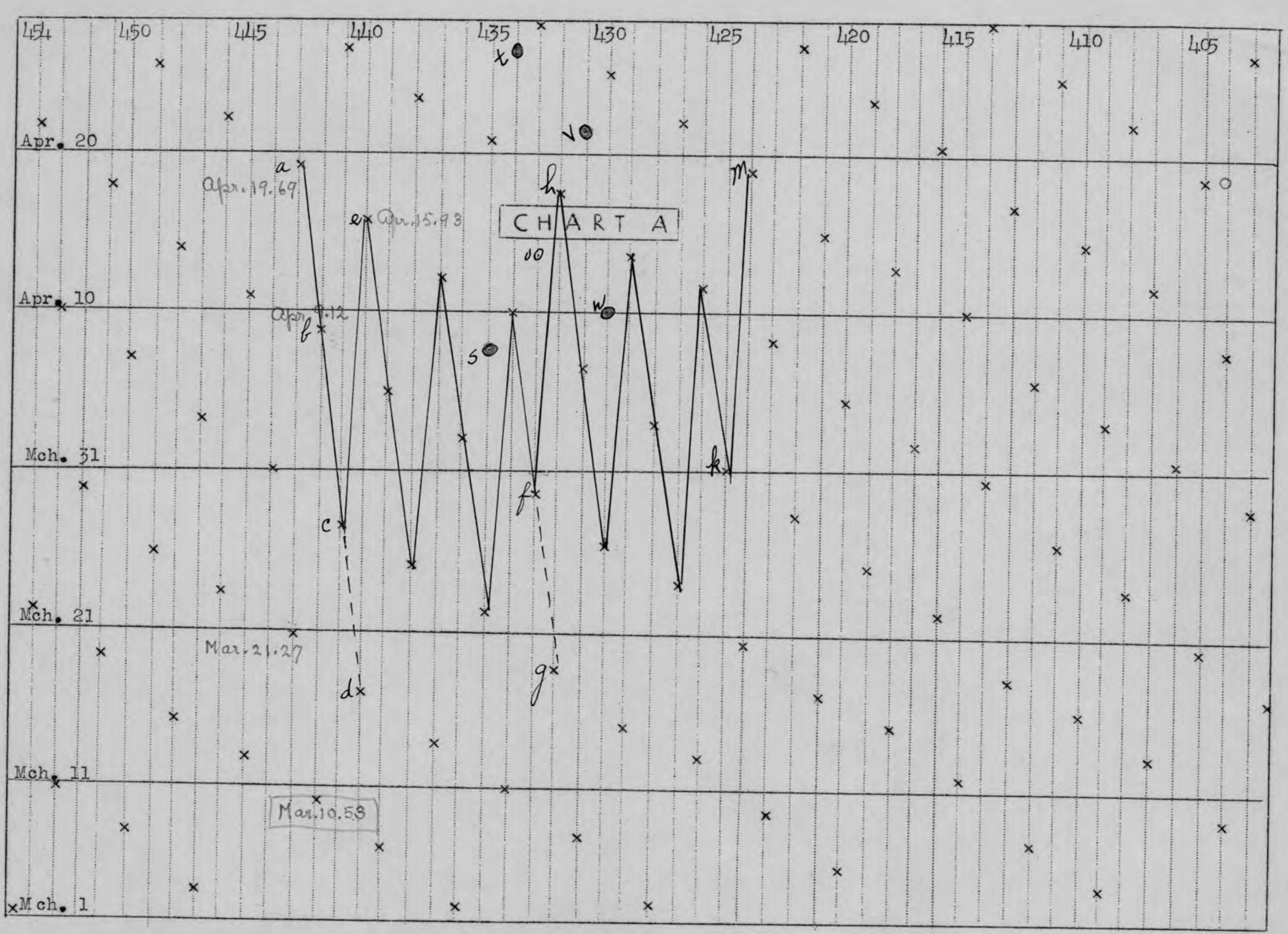
[1] F. K. Ginzel, Handbuch der Mathematischen und Technischen Chronologie, Vol. 1, 163.

[2] F. K. Ginzel, Op. Cit., Vol. I, p. 547 f.



Graph showing positions of Lunar Conjunctions for March and April 454 B. C.,--402 B. C.

as shown by the dotted line down to "d", the following year, which would be March 17.27--it would throw the beginning conjunction of the year more than a month earlier than at point "a". In order to avoid this, an intercalary month is put in in the spring of 440 that throws the beginning conjunction of the year back to the point "e" or April 15.93. In this way it continues until the point "f" at 433. If it went down as far as the point "g" shown by the dotted line, it would again go below March 21. Therefore, instead of going to "g", it goes up to a new high at "h" which is April 17.71. Continuing as before, it does not go lower than at point "k" in 425 B. C., for the same reason, but jumps up to a new high at "m" which is almost exactly the same place in the calendar as at "a". This is the nineteen-year cycle.

At the end of every nineteen years, the sun and moon would return approximately to the same position. For instance, nineteen years later than 424 at "o", 405 B. C., it is noticed that the conjunction is in the same position in the calendar. It will also be noted that there is a certain order called a mnemonic by which these intercalations are made that will keep the first of the year in this same season. Tracing the path of the moon through these nineteen years, it is noticed that there are three conjunctions, "a", "b", and "c", and then an intercalation, three more conjunctions, and an intercalation, three more conjunctions and an intercalation, then two conjunctions and an intercalation, etc.--so that the order in terms of conjunctions for the nineteen-year cycle may be summed up as 3-3-3-2-3-3-2. The position of the full moon as occurring approximately half way between the given conjunctions for any year may be found as at points "s", "t", "u", "v", and "w". With this kind of a mnemonic, it is easy to see how the yearly calendar operating on a luni-solar basis can be made to conform to the seasons of the year by the introduction of such a mnemonic at almost any season. There was a time when the Sumerians intercalated their year in the fall but from the fifth century on, the intercalations for lunar calendars were made in the spring.

Chart B, page 10, shows how such a nineteen-year cycle has to be constructed in order to make possible the falling of the Passover on the first full moon after the vernal equinox. For instance, the lowest point in the mnemonic in this chart is for the year 434 B. C., at which time the conjunction comes March 12.18. The full moon coming between fourteen and fifteen days later, as at "x", would come well past the vernal equinox. This represents the common custom of the intercalations made in the working out of the Orthodox Jewish calendar of modern times.

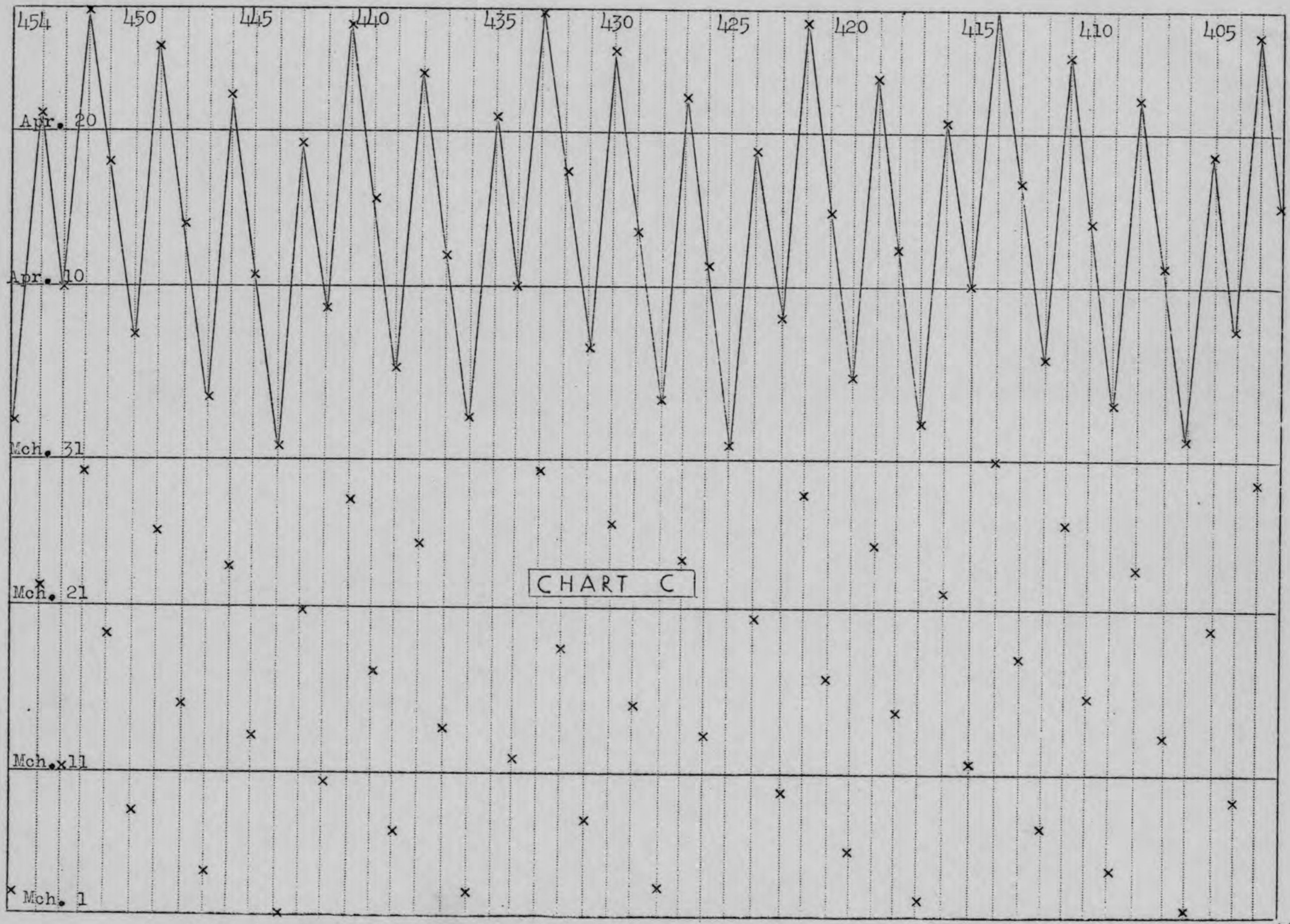
Chart C, page 11, shows how a similar nineteen-year cycle might be constructed so that all of the conjunctions would fall within the month of April, while Chart D, page 12, shows how the same kind of a mnemonic could control the conjunctions marking the beginning of the year in such as way as to bring no Passover earlier than the 7th of April.

Eight of the papyri found at Assuan are dated both in terms of the Aramaic calendar and in terms of the Egyptian calendar. The comparative translations of these papyri are shown on page 13. For an illustration take Papyrus "A". This papyrus starts off, "in the 18th of Elul, that is the 28th day of Pachons in the 15th year of Xerxes." From the Canon of Ptolemy, it is determined that the 15th year of Xerxes most nearly corresponds with the year 471 B. C. Now, the Egyptian year as explained above contained twelve months of thirty days each and are named in the following order:

Thoth
Phaophi
Athyr
Choiak oeak
Tybi
Mechir
Phamenoth
Pharmouthi
Pachons
Payni
Epiphi
Mesorè

5 Epogomenae (Blank days)

The Jewish months during the first half of the year alternated thirty



Graph Showing How by Using the Same King of a Mnemonic All Changes of the Year Take Place in the Month of April

COMPARATIVE TRANSLATIONS OF THE ASSUAN PAPYRI

Papyrus	A. E. Cowley				E. B. Knobel				J. K. Fotheringham			
	Jew. Date	Eg. Date	Reign	Yr.	Jew. Date	Eg. Date	Reign	Yr.	Jew. Date	Eg. Date	Reign	Yr.
A	18 Elul	28 Pachons	15 Xerxes	471	18 Elul	28 Pachons	15th of Xerxes	471	17, (18) Elul	27, (28) Pachons	14, (15) Xerxes	471
B	18 Chisleu	7 Thoth	21; Begin. of Artax.	465	18 Chisleu	6 Thoth	1st of Artax.	464	18 Chisleu	6, (7)(8)? Thoth	20, (21) Xerxes	464
D	21 Chisleu	1 Mesore	6th of Artax.	459	Cannot be harmonized				21 Chisleu	1 Mesore	6, (5) Artax.	460
E	3 Chisleu	10 Mesore	19th of Artax.	447	3 Chisleu	10 Mesore	19th of Artax.	446	3 Chisleu	10 Mesore	19th of Artax.	446
F	14 Ab	19 Pachons	25th of Artax.	441	14 Ab	19 Pachons	25th of Artax.	440	13, (14) Ab	19 Pachons	25th of Artax.	440
G	25 Tishri	6 Epiphi	- - - - -	441		Suggests Year		446	26 Tishri	6 Epiphi	- - - - -	446
H	Elul	Payni	4th of Darius	420		Suggests Year		420		Suggests Year		420
J	3 Chisleu Yr. 8	12 Thoth Yr. 9	8, 9th of Darius	416	3 Chisleu	12 Thoth	8th of Darius	416	3 Chisleu	11, (12) Thoth	7, (8)(9) Darius	416
K	24 Shebat Yr. 13	9 Athyr Yr. 14	13, 14 of Darius	410	24 Shebat	9 Athyr	4th of Darius	410	23, (24) Shebat	8, (9) Athyr	13, (14) Darius	410
	A. E. Cowley Aramaic Papyri of the 5th Century, B. C. Oxford Clarendon Press (1923)				E. B. Knobel "Suggested Explanation of the Ancient Jewish Calendar Dates on the Aramaic Papyri." Monthly Notices R.A.S. LXVIII, (1908) London R.A.S. (1908) pp. 334 - 345.				J. K. Fotheringham "Calendar Dates in the Aramaic Papyri from Assuan." Monthly Notices R.A.S., LXIX (1908) London, R.A.S., (1909) pp. 12 - 20.			

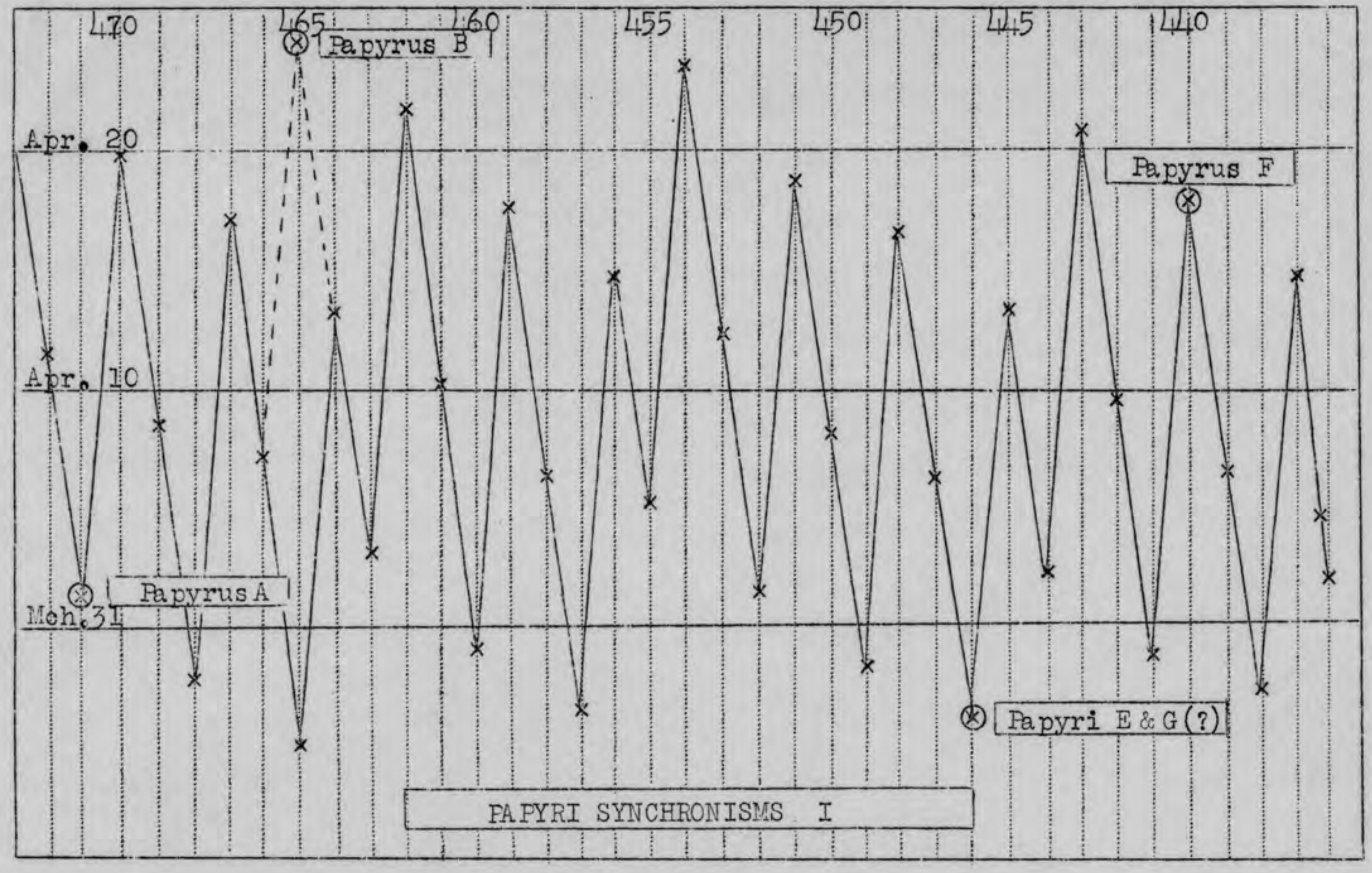
and twenty-nine days. The location of the first day of Nisan, the new year's day of the ritualistic calendar became, therefore, a very important responsibility. The last six months contain certain variations demanded by the moon to keep the first of the month as early as possible in harmony with the new moon crescent. Because of the irregularities in the motion of the moon, the ordinary year at times had 354 days and at other times 355 days. The addition of an intercalary month brough the total up to 383 days or 384 days as demanded by the moon. The following table showing the names of the Jewish months, together with their days during the different years, may make this clear:

					Leap Year	
			Reg.	Abun.	Def.	Reg.
Nisan	30	Marchesvan	29	30	29	29
Iyyar	29	Chisleu	30	30	29	30
Sivan	30	Tebeth	29	29	29	29
Tammuz	29	Shebat	30	30	30	30
Ab	30	Adar	29	29	30	30
Elul	29	Ve-Adar			29	29
Tishri	30		354	355	383	384

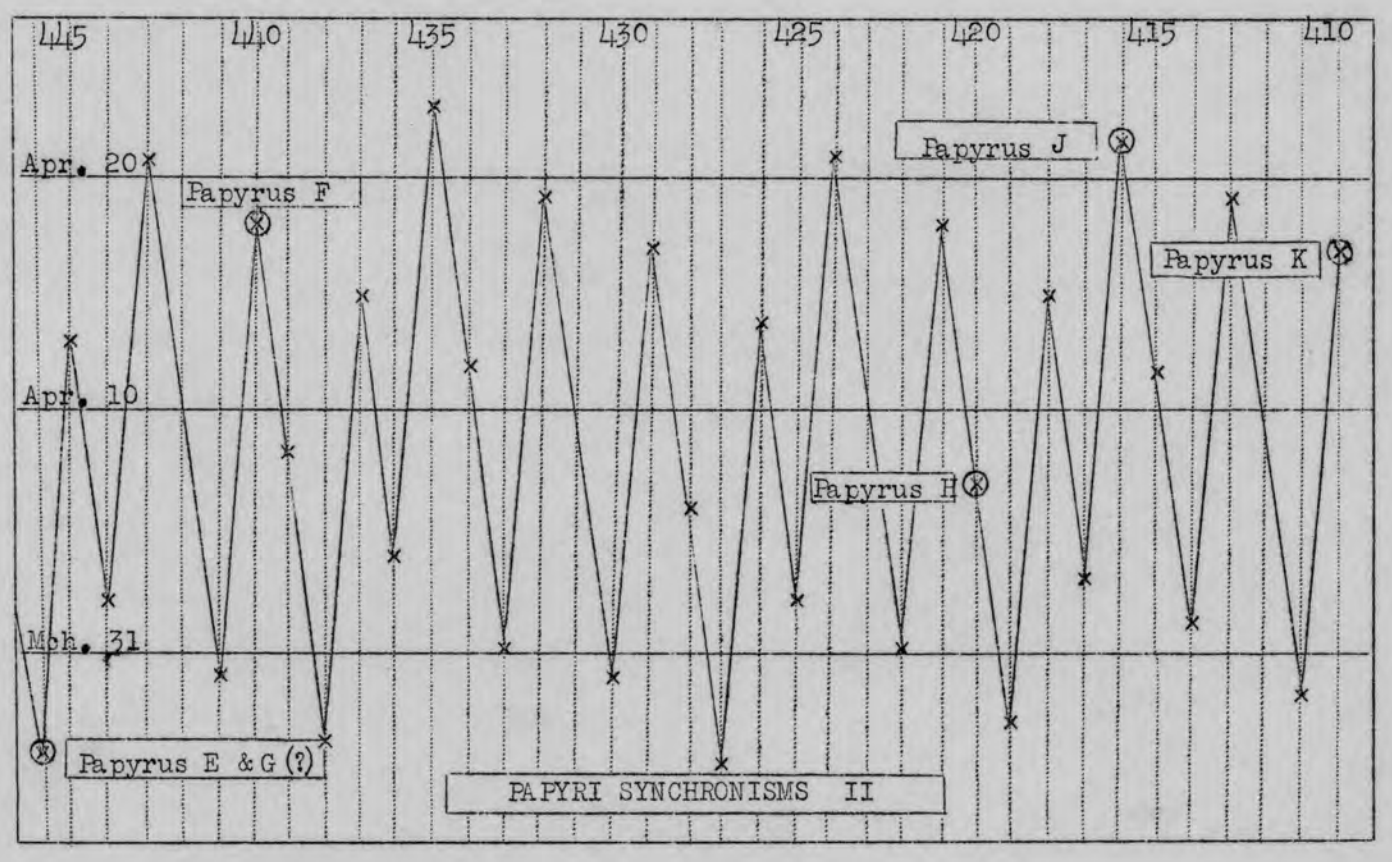
Knowing the date of the beginning of the new year according to Egyptian reckoning, from the Canon of Ptolemy one can easily interpret the 28th of Pachons in Papyrus "A" in terms of the Julian calendar. In this illustration, for instance, the 28th of Pachons 9th month in the 15th year of Xerxes is the 12th of Sept., 471. Assuming for the moment that the Jews calculated their year on the basis just explained, there would be 166 days from the 18th of Elul back to the 1st of Nisan (inc.) If the nineteen year cycle were planned in such a way as to make this possible, it would mean that the conjunction beginning the Jewish year would be the one falling March 30.39. By computation this proved to be correct.

In the same way the synchronisms of each papyrus were worked out, and it was found that they fitted exactly a nineteen-year cycle with intercalations made as shown in Chart D. (See page 15.)

Note on Postponements and 353 and 385 day year



PAPYRI SYNCHRONISMS I

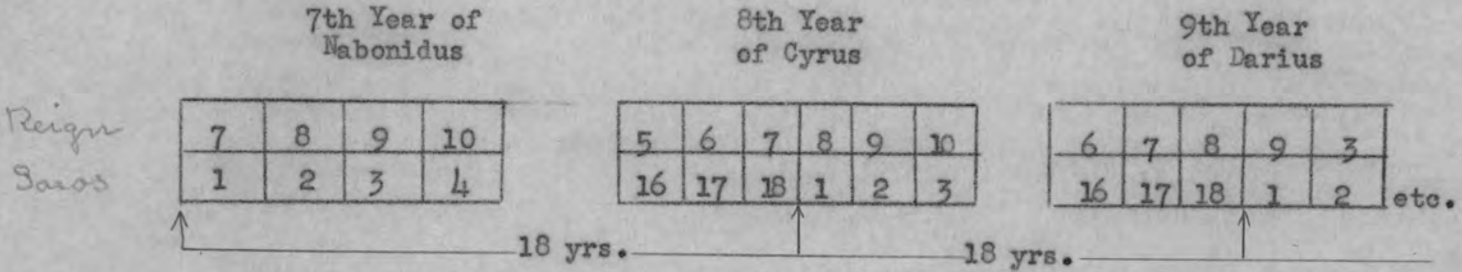


PAPYRI SYNCHRONISMS II

middle of page 2

The Babylonians and Persians possessed no special eras of calendrical reckoning, such as the Greeks had in their Olympiads, by which it might be possible to continuously check the length of reigns, but Strassmaier discusses quite at length a <u>Saros Tablet</u> found in the British Museum in 180$\overset{8}{4}$ and first published in the <u>Proceedings of the Society of Biblical Archaeology</u>, giving a list of kings ruling at the 18-year intervals of the saros period together with the year of their reigns corresponding to the first year of the period.[1]

Insofar as the tablet goes, these periods begin with the 7th year of Nabonidus. All this tablet p~~re~~urports to do is to tell in what year of the reigning monarch the first year of the saros occurs. Thus:



7th Year of Nabonidus

Reign	7	8	9	10
Saros	1	2	3	4

8th Year of Cyrus

5	6	7	8	9	10
16	17	18	1	2	3

9th Year of Darius

6	7	8	9	3
16	17	18	1	2

etc.

18 yrs. 18 yrs.

The number on the tablet just before the king's name is year 1 of the 18-year saros period. Thus year 7 of the reign of Nabonidus corresponds with year 1 of this saros period or 18-year cycle. The year 8 of the reign of Cyrus then corresponds with year 1 of the next saros period. The following table is a

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It is an eclipse cycle, at the end of which

[1] Strassmaier, Zeitschrift fur Assyriologie, Vol. VII, (1892), 199 ff. Vol. VIII (1843), 106 ff. The word "saros" refers to a Babylonian lunar cycle of 223 lunations or 6585.32 days. At the end of this saros period, the centers of the sun and moon return so nearly to their relative position at the beginning of that period that the eclipses, both solar and lunar, of the next 18 years can be predicted with astonishing accuracy. In one of these saros periods, there are about 29 lunar eclipses and 41 solar eclipses. Because of the slight difference in the relative position of the sun and moon, these returning eclipses in the following saros period appear in longitudes approximately one-third of the distance around the world west of the regions where they were first noted.

Saros tablet

* This ~~table,~~ therefore, becomes an excellent means of checking the reigns of the Persian period from an astronomical viewpoint. For all of these Persian kings, contract tablets have been found dated in the "accession" year. This accession year is a distinct year from the first year of the king's reign. The latest tablet for Nabonidus, for example, is dated in the 17th year and the 9th month.[3] This harmonizes with the length of reign given Nabonidus by Ptolemy in his Canon. If now the "accession year" of Cyrus was a year different from either the 17th year of Nabonidus or the 1st year of Cyrus' reign, the 18-year saros period would reach only to the 7th year of Cyrus and not the 8th, thus:

translation of the first portion of this saros tablet covering the years from Nabonidus through the 36th year of Artaxerxes. That which is enclosed in parentheses has been restored, by Strassmaier for that portion of the tablet was broken. From other sources, however, it is easy to accurately ~~restore~~ complete the missing portions.

Portion of the Saros Tablet Covering the Fifth Century[2]

7	Nabonidus	(18)
(8)	Cyrus	18
9	Darius	18
27	Darius	18
9	Xerxes	18
6	Artaxerxes	18
(24	Artaxerx)es	(18)
(1	Darius II	(18)
19	Darius II	18
18	Artaxerxes II	18
36	Artaxerxes II	18

*

				Nabonidus											Cyrus					
Reign	7	8	9	10	11	12	13	14	15	16	17	ACC.	1	2	3	4	5	6	7	8
Saros	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1	2

~~Saros tablet~~

HOwever, if the "death year" of Nabonidus and the "accession year" of Cyrus are counted as one and the same year, the first year of Cyrus' reign beginning with the new calendar year, then the record of the saros tablet becomes exact, thus:

				Nabonidus											Cyrus					
	7	8	9	10	11	12	13	14	15	16	17A	1	2	3	4	5	6	7	8	9
Year of Saros	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1	2

~~Saros tablet~~

This may be checked with all the kings named on the list and found to work in exactly the same manner, th~~is~~us definitely proving that in the Babylonian-Persian chronology, the death year of the king is counted as the last year of his reign and is also counted as the accession year of the following king, thus:

Nabonidus		Cyrus
16	17 Death Year & Access. Year.	1

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[2] Arno Poebel, (Republished and discussed) <u>A J S L</u>, LVI (1939), 121-146.

[3] Strassmaier, Zeitschrift fur Assyriologie, Vol. IV, Nabonidus Tablet No. 1055.

The official "first year" of the new king's reign began with the new calendar year. As has been demonstrated earlier in this discussion, this is identically the same method as that used by the Jews at this same period in history, the only variation being that the Babylonian-Persian civil year began in the spring, while the Jewish civil year began as will be demonstrated in this study, from the following fall. This will become more and more evident in the present study of some Aramaic papyri that were found at Assuan about the turn of the century and first published in 1906.[4]

In the Egyptian calendar religious texts inscribed during the V and VI dynasties show that a calendar of 365 days was used. This calendar comprised 12 months of 30 days each plus 5 Epagomenae or blank days needed to complete the year. There was no intercalation in this calendar; therefore, every year was approximately one-fourth of a day short of the true ~~tropical~~ solar year. This meant that every four years, the first of Thoth or new year's day, would drop back one day in terms of the Julian calendar, so that in 1460 years--or what is known as a Sothic cycle,--the new year's day would recede back through the all the months of the year and return to its original starting point. From the information obtained

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[4] Sayce and Cowley, Aramaic Papyri Discovered at Assuan. Assuan is located on the Nile just below the first cataract, some 120 miles south of the ancient capital of Thebes. At the time of the 5th century B. C. when these documents were written, the sight was called Syene. At this place a colony of Jews had settled, evidently going down into Egypt either from Babylon or from Palestine during the period of the restoration. These documents cover a large portion of the 5th century B. C., being dated from the 15th year of ~~Cyrus,~~ Xerxes, (471 B. C) to the 14th year of Darius II (410 B. C.). Most of these papyri are perfectly legible and relate to conveyances of land and buildings, marriage contracts, and various legal processes between members of this Jewish colony. They are drawn with great care, being signed and properly witnessed and many of them still sealed at the time of discovery. At least 8 of them are dated according to both the Hebrew and Egyptian calendars. Some of them are more specific than others giving special regnal years according to the calendar in which the date is given. Thus in papyrus "K" which will be definitely described a bit later, the date is given as follows: "In the 24th of Shebat in the 13th year, that is the 9th day of Athyr, in the 14th year of Darius." Others are less specific giving the regnal year in connection with the second date only taking it for granted that anyone conversant with the two calendars will understand definitely just which regnal year is meant. Thus papyrus "F" begins, "In the 13/14th day of Ab, that is, the 19th day of Pachons, in the 25th year of Arta-Xerxes."

from the Ptolemaic *Almagest*, it is not difficult to definitely place the first day of Thoth in terms of the Julian calendar. From the time of Nabu-nasir, 747 B. C., this Egyptian calendar was used more and more. It is difficult, however, to determine just when the Egyptians began their civil day. Ptolemy based all his astronomical calculations of time intervals upon noon, February 26, 747, as a starting point. But Ginzel says that Ptolemy did this for astronomical reckoning only, and he quotes several ancient authorities as disagreeing as to the exact time of the beginning of the Egyptian civil day. Some authorities want it to be reckoned from dawn to dawn, while others think the Egyptians began the day from midnight, and still others want it to begin at sunset. For the purpose of this discussion, the day is arbitrarily considered as beginning at sunset as it makes computations and diagrams a bit less confused.

In reckoning the years of a king's reign, Ptolemy digresses from the method used by the other nations, by giving the new king no "accession year" and giving the "death year" of the king to the incoming occupant of the throne. Thus at whatever time in the year a king came to the throne, Ptolemy counted his reign as beginning with the first of Thoth or new year's day in that year, and called that year, "year one." This may be checked at various points in his Canon. For instance, the death of Alexander occured in May, 323 B. C., but the first year of Philip Aridaeus, his successor, begins, according to Ptolemy, with the first of Thoth in the 425th year of the Canon which in terms of the Julian calendar, began ~~was~~ November 12, 324 B. C. Tiberius died in March A.D. 37, but Ptolemy makes the reign of Caligula begin with the first of Thoth in the 784th year of the Canon, or August 14, A. D. 36.[5]

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[5] Of course, all recognize that Ptolemy's Canon does not give the equivalent dates of these reigns in terms of the Julian calendar. Ptolemy was an astronomer and mathematican, and not a historian. However, from his *Almagest*, one is able to obtain the length of reign of the various kings in terms of the years that have elapsed since the beginning of the reign of Nabu-nasir. From a critical analysis of the *Almagest*, it is not difficult to show that the starting point of all of Ptolemy's computations was noon, February 26, 747 B. C. Anyone wishing further information concerning the list of kings of his Canon together with the Julian equivalent of their reigns, may find them discussed in a number of places. See, for instance, Curt Wachsmuth, *Studien der Alten Geschietche*, pp. 305,306; F. K. Ginzel, *Handbuch der Mathematischen und Technishcen Chronologie*, Vol. 2, p. 576 ff; H. Gratton Guinness, *Creation Centered in Christ*, Vol. 1, pp. 297 ff.

For the purpose of reference, the following list of kings covers that part of the Canon which deals with the portion of the Persian Period under discussion here, and gives the Julian equivalent (Ginzel's translation) of the inclusive dates of each king's reign.

LIST OF KINGS COVERING THE PERSIAN PERIOD
COMPUTED FROM PTOLEMY'S CALCULATIONS

King	Length of Reign	Last Year of Reign in Serial Year of Canon	Ginzel B. C. Julian Equiv. From, to and includ.
Nabonidus	17	209	9 Jan. 555 - 4 Jan. 538
Cyrus	9	218	5 Jan. 538 - 2 Jan. 529
Cambyses	8	226	3 Jan. 529 - 31 Dec. 522
Darius I	36	262	1 Jan. 521 - 22 Dec. 486
Xerxes	21	283	23 Dec. 486 - 16 Dec. 465
Artaxerxes	41	324	17 Dec. 465 - 6 Dec. 424
Darius II	19	343	7 Dec. 424 - 1 Dec. 405
Artaxerxes II	46	389	2 Dec. 405 - 20 Nov. 359

With such a wandering calendar as the Egyptians possessed, it was not possible to tie their calendar ~~in with~~ to the agricultural seasons but when once understood, the calendar becomes very useful in checking with the Saros tablet and the Olympiads, in determining the exact length of the reigns of the various kings.

The Greek era began in 776 B. C., a few days after the summer solstice. This system of chronology was used quite extensively by the ancient historians but is not tied in to any agricultural system. It is divided into Olympiads of four years each with each individual year named after the Archon of Athens who was appointed for that year only. Thus it also becomes an excellent means of checking other data and for the purposes of this study has been translated in terms of the Julian calendar, as will be seen in the various diagrams made illustrating the papyri.

(Turn to page 5 in paper--"No one doubts that the Hebrew calendar. . . ." etc.).

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