Journal of Cuneiform Studies

Volume 46 **1994**

CONTENTS

RITUALS FOR AN ECLIPSE POSSIBILITY IN THE 8TH YEAR OF CYRUS[1]

Paul-Alain Beaulieu and John P. Britton
Yale University

If we distribute the 5-month intervals in a Saros as uniformly as possible, we obtain groups of 7 or 8 eclipse possibilities separated by 5-month intervals, where eclipse possibilities within each group occur at 6-month intervals.[22] If we then fix the pattern of these groups within a cycle and fit the resulting cycles to the historical eclipse record so that the 5-month intervals immediately precede the first eclipse of each group in some cycle, we obtain a distribution of eclipses and eclipse possibilities similar to Figure 2.

Here the dates of all eclipse possibilities from the beginning of the reign of Nabonassar are arranged in columns of 38, so that each column covers a single Saros, and dates in the same row (except in the last column) are always separated by some multiple of 223 months. Dates on which an eclipse was visible at Babylon are unshaded, while heavy shading indicates that no eclipse was visible at Babylon on that date. No distinction is made between eclipses which were invisible at Babylon and eclipse possibilities at which no eclipse took place. The location of 5-month intervals is indicated by horizontal rulings; elsewhere eclipse possibilities are separated by 6 months. The eclipse possibility which is the subject of our two depositions is highlighted in the square near the bottom right corner of the figure in SC 12 (SC = Saros cycle).

Figure 2 illustrates the shift in the bands of empty eclipse possibilities which results from the error in the Saros cycle. Typically, these consist of two eclipse possibilities where no eclipse occurs,[23] initially at the end of each group and thus ending with a 5-month interval. Slowly, however, these bands of empty eclipse possibilities drift "downwards," with the result that eclipses begin to disappear in the first eclipse possibility of some groups where formerly they

22. Cf. Aaboe [1972, 114–15] and Britton [1989, 14–21].

23. In figure 2 there are only two instances of visible eclipses separated by 11 months (and thus by only one empty eclipse possibility): SC 4, EP# 21 and 23; and SC 12, EP# 14 and 16.

LUNAR ECLIPSE POSSIBILITIES: -746 TO -508

	SC = 0		SC = 1		SC = 2		SC = 3		SC = 4		SC = 5		SC = 6		SC = 7		SC = 8		SC = 9		SC = 10		SC = 11		SC = 12		SC = 13	
	EP# 31 =		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*		*EP# 1 =*	
	0 NBNSR		*4 NBNSR*		*1 ULULA*		*2 SARG2*		*3 MUSMK*		*9 ASHRD*		*14 SSSUK*		*12 KANDL*		*8NBPLS*		*5 NBKDR*		*23 NBKDR*		*41 NBKDR*		*10 NBNID*		*3 CAMBS*	
	-746:2/6		*-743:11/25*		*-725:12/6*		*-707:12/16*		*-689:12/28*		*-670: 1/ 7*		*-652: 1/18*		*-634: 1/29*		*-616: 2/19*		*-598: 2/19*		*-580: 3/ 2*		*-562: 3/13*		*-544: 3/23*		*-526: 4/4*	
EP#	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo	Yr	Mo
1			4	IX		IX		X		X		X		X		XI		XI		XI		XII		XII		XII	3**	I
2			5	III	2	III	3	III	4*?	IV	10	IV	15	IV	13*?	V	9	V	6	V	24	V	42*	VI	11	VI		VI2
3				IX		IX		IX	SANH2	X ?		X		X		XI		XI		XI		XII		XII		XII		XII
4			6**	III	3**	III	4	III	1	III	11**	IV	16	IV	14	IV	10**	V	7**	V	25	V	43	V	12*	VI	4	VI
5				VIII?		VIII?		IX		IX		IX		X		X		X		X		XI	AMLMK	XI		XII		XII
6			7	II	4	II	5*?	III	2	III	12	III	17**	IV	15	IV	11	IV	8	IV	26*	V	1	V	13	V	5*	VI
7				VIII		VIII	SANH1	IX ?		IX		IX		IX		X		X		X		XI		XI		XI		XII
8			8**	I	5	I	1	I	3**	II	13*	II	18	II	16**	III	12*	III	9**	III	27	III	2*	IV	14	IV	6	V
9				VI2?	MKAID	VII		VII		VII	SSSUK	VIII		VIII		VIII?		IX		VIII		IX	NLSUS	X		X		X
10				XII?	1**	I	2	I	4	I	1**	II	19	II	17	II	13	II	10	II	28*	III	1	III	15*	IV	7	IV
11			9	VI		VI2?	BELIB	VII		VII		VII		VIII		VIII		VIII		IX		IX		X		X		X
12				XII		XII	1**	I	5*	I	2 1?	I	20**	II	18	II	14	II	11*	II	29	II	2	III	16	III	8*	IV
13			10	VI	2	VI		VI2?		VII		VII	KANDL	VII		VIII		VIII		VIII		IX		IX		IX		X
14				XII		XII		XII		XII2	3*	I	1	I	19**	II	15**	II	12	I	30	II	3*	III	17	III	1	III
15			11**	VI	3**	VI	2	VI	6	VI		VII		VII		VII		VII		VII		VIII		IX	CYRUS	IX		IX
16				X ?		XI?		XI		XI		XII		XII		XII		XII		XII	31**	I	4	I	1	II	2	III
17			12	IV	4	IV	3*?	V	7	V	4	V	2*	VI	20	VI	16	VI	13	VI		VI2	NBNID	VII		VIII		VIII
18				X		X	ASNSM	XI		XI		XI		XII		XII		XII		XII		XII	1*	I	2**	II	3**	II
19			13**	IV	5	IV	1	IV	8**	V	5	V	3	V	21	VI	17	VI	14*	VI	32	VI		VII		VII		VII
20				IX ?		X		X	ASHRD	X		XI		XI		XII		XII		XII		XII		XII2	3*	I	4	I
21			14	III?	6*?	IV	2	IV	1	IV	6*	V	4	V	22**	VI	18**	VI	15	V	33*	VI	2	VI		VII		VII
22			NBND2	IX ?		X ?		X		X		XI		XI	NBPLS	XI		XI		XI		XII		XII		XII2	5*	I
23			1	II	7	II	3*?	III	2	III	7	III	5**	III	1	IV	19 1	IV	16	IV	34	IV	3*	V	4	V		VII
24				VIII		VIII		IX ?		IX		IX		IX		X		X		X		XI		XI		XI		XII
25			2*?	II	8	II	4	II	3*	III	8	III	6	III	2*	IV	20*	IV	17*	IV	35	IV	4	IV	5	V	6	V
26			UKNZR	VIII?		VIII		VIII		IX		IX		IX		X		X		X		X		X		XI		XI
27			1	I	9*?	II	5	II	4	II	9**	III	7	III	3	III	21	III	18	III	36*	IV	5	IV	6*	V	7	V
28				VII		VIII?		VIII		VIII		VIII		IX		IX	NBKDR	IX		IX		X		X		XI		XI
29			2	I	10	I	6*?	II	5*	II	10	II	8*	III	4	III	1	III	19	III	37	III	6*	IV	7	IV	8*	V
30	NBNSR			VII		VII		VIII?		VIII		VIII		IX		IX		IX		IX		IX		X		X		XI
31	0	XII	2	XII		XII	NLUSZ	XII		XII2	11*	I	9	I	5**	II	2**	II	20	II	38	II	7	II	8	III	9	IV
32	1**	VI	3**	VI	11	VI	1	VI	6	VI		VII		VII		VII		VII		VIII		VIII		VIII		IX		IX
33		IX	PULU	XI ?		XII	MUSMK	XII		XII		XII2	10*	I	6	I	3	I	21**	II	39	II	8	II	9**	III	10	III
34	2	V	1	V	12**	VI	1	VI	7	VI	12	VI		VII		VII		VII		VII		VIII		VIII	CAMBS	VIII		IX
35		XI		XI	SARG2	XI ?		XII		XII		XII		XII2	7*	I	4	I	22	I	40	II	9	II	1	II	11**	III
36	3**	V	2*?	V	1	V	2**	VI	8*	VI	13	VI	11	VI		VII		VII		VII		VIII		VIII		VIII		IX
37		X	ULULA	XI ?		XI		XI ?		XII		XII		XII		XII2	5**	I	23*	I	41**	II	10**	II	2	II	12	II
38	4	IV	1	IV	2*?	V	3	V	9	V	14*	VI	12	VI	8	VI		VI2		VII		VII		VII		VIII		VIII

Eclipse visible at Babylon

No Eclipse visible at Babylon

Eclipse possibly visible at Babylon

Figure 2

had appeared with only intermittent interruptions for daytime eclipses. This first occurs in the fourth group in our table, where eclipses disappear in line (EP#) 23 beginning in SC 5. Subsequently, eclipses disappear at the beginnings of the second and fifth groups (EP# 8 and 31) beginning in SC 8.

Similarly, eclipses also begin to appear towards the end of groups at eclipse possibilities which hitherto had been empty. This happens in the third group (EP# 21) in SC 4, in the first group (EP# 6) in SC 5, in the fourth group (EP# 29) in SC 11, and in the second and fifth groups in SC 12. Thus by the date of our texts, considerable evidence would have accumulated that the pattern of eclipses expected from the Saros cycle was changing in the vicinity of all group boundaries except that shown with double scoring which defines the cycles in Figure 2.

The scheme shown in Figure 2 is very nearly identical to a scheme, found in later texts and most prominently in the so-called "Saros Canon," which is attested for at least 14 Saros cycles beginning in -490 (SC 15) and ending in -238 (SC 28).[24] This scheme begins and ends with the same eclipse possibilities as that shown in Figure 2, but the other 5-month intervals are all shifted downwards by one row. This structure is shown in SC 13 in Figure 2, which is the earliest cycle for which it fits the actual eclipse record.[25] It is reflected in at least one astronomical text composed probably in the second half of the 5th century,[26] which suggests that it was introduced at some time in the century following the date of our depositions.

In sum it seems certain that the Saros cycle was known to the Babylonians and used to predict the dates of possible eclipses by at least the middle of the 6th century B.C. and most probably long before that.[27] Indeed, it seems quite possible that a scheme similar to that shown in Figure 2 was already used for that purpose, although perhaps starting with the group we have placed last in Figure 2 to facilitate comparison with the "reformed Saros" from later texts.[28]

24. These texts are published and discussed in Aaboe, Britton, Henderson, Neugebauer, and Sachs [1991, 4-33], where it is noted (p. 14) that this scheme may have extended two cycles earlier to -526.

25. The later scheme is inconsistent with the eclipse in month II of the 1st year of Cyrus as well as earlier eclipses in EP# 6.

26. "Text S" (BM 36599+ and 36737+): originally published by Aaboe and Sachs [1969]. An additional fragment (BM 36580) is published in Aaboe, Britton, Henderson, Neugebauer, and Sachs [1991], and the entire text with revisions is discussed in Britton [1989, (esp. 29ff.)].

27. Parpola [*LAS* 2, 51] notes that Assyrian scholars of the early 7th century B.C. "certainly had recognized the 47-month eclipse period and probably also the 18-year 'Saros'." In general Assyrian scholars appear to have predicted large lunar eclipses with confidence; partial lunar eclipses as possibilities to be watched for; and solar eclipses as possibilities at the beginning or end of a month in which a lunar eclipse was possible.

28. This possibility is (mildly) supported by evidence from both earlier and later observational reports, which reflect a distribution of 5-month intervals which is identical to that shown in Figure 2 for cycles SC 0 to SC 12. Cf. Aaboe, Britton, Henderson, Neugebauer, and Sachs [1991, 20].