MAYA HIEROGLYPHIC WRITING

An Introduction

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UNIVERSITY OF OKLAHOMA PRESS : NORMAN

Manufactured in the United States of America.
First printing, January, 1960; second printing, March, 1962;
third printing, August, 1966.

The Synodical Revolution of Venus

The synodical revolution of Venus averages 583.92 days. It may be as little as 581 or as much as 587 days. The interval of 584 days therefore was a very good approximation to the mean. This number was of prime importance to the Maya because of the facility with which it could be related to the year of 365 days, and to the sacred almanac of 260 days. The common factor of 584 (8×73) and 365 (5×73) is 73. Therefore in 2920 days (5×584 or 8×365) exactly five synodical revolutions of Venus and eight years of 365 days will have completed themselves, and the two periods once again share the same *lub.* A longer period, but an extremely convenient one, is necessary to harmonize the synodical revolution of Venus with the sacred almanac, for the highest common factor is 4. A total of 37,960 days will pass before the two cycles will end on the same day. That number, however, is two CR (5.5.8.0), at which time the vague year of 365 days also ends on the same day. In other words after two CR there will have elapsed 65 synodical revolutions of Venus, 104 years of 365 days and 146 rounds of the sacred almanac. All three periods will reach the *lubay,* "the great resting place," together.

There is no reliable evidence that the Maya were acquainted with the sidereal revolution of Venus or of any other planet.

Venus Tables in Codex Dresden

The tables of Venus in Dresden, identified as such by Förstemann many years ago, apportion the synodical revolution in four uneven divisions of 236, 90, 250, and 8 days. From Mexican sources we know that the period of invisibility at inferior conjunction was reckoned as eight days. It is therefore obvious that the cycle was counted from heliacal rising, four days after inferior conjunction, when the planet is first visible as morning star. To the period of visibility as morning star were assigned 236 days, at the end of which Venus was lost to view in the solar light. In 90 days Venus, continuing its unseen course, passed through superior conjunction to its second heliacal rising, as evening star. After 250 days as evening star it was once more lost in the sun's rays to pass four days later through inferior conjunction and then, at the end of eight days, to reappear as morning star, thereby completing the revolution of 584 days.

As 584 divided by 20 has a remainder of 4, it is clear that heliacal risings of Venus as morning star can occur only on days at intervals of four days in the official revolution of the planet, but observed risings could occur on any day because actual revolutions of Venus vary in length from 581 to about 587 days. These official days of heliacal rising were Ahau, Kan, Lamat, Eb, and Cib. As 584 divided by 13 has a remainder of 12, it follows that the coefficient of the day increases by 12 (or decreases by 1) at each new heliacal rising. Heliacal risings, therefore, follow in the sequence 1 Ahau, 13 Kan, 12 Lamat, 11 Eb, 10 Cib, 9 Ahau, 8 Kan, etc., an arrangement which greatly simplified calculations.

In the table of Venus which occupies Dresden 46–50 the days on which the revolutions end, and the intervening days of disappearance before superior conjunction, reappearance, and second disappearance occupy the upper compartment of the left half of each page. The material is transcribed in Table 17. The starting point is the end of the table, the day 1 Ahau. The number 236 in line 26 is counted from 1 Ahau to reach 3 Cib, at the left of line 1. This is the day of disappearance. The addition of 90 days (line 26) leads to reappearance as evening star at 2 Cimi (line 1), and 250 additional days carry the count to second disappearance at 5 Cib. Inferior conjunction, four days later, is not noted. Instead, the tally advances eight days (line 26) to a new heliacal rising at 13 Kan (line 1).

The process repeats: Venus passes through the three stages to a third heliacal rising at 12 Lamat (line 1, last column of p. 47), to a fourth at 11 Eb (line 1, last column of p. 48), to a fifth at 10 Cib (line 1, last column of p. 49), and to a sixth at 9 Ahau (line 1, last column of table). Thence the sequence is across the second line, passing through the intermediate points to heliacal risings at 8 Kan, 7 Lamat, 6 Eb, 5 Cib, and 4 Ahau. The series succeeds line by line until the table is completed when the day 1 Ahau is again reached as the date of a heliacal rising (line 13 extreme right), the total of 65 revolutions of the planets having been counted. The series then repeats in the same sequence.

Line 19 gives the totals of days elapsed in the course of the five revolutions comprised in a horizontal line. Line 15, omitted from the table, repeats the same glyph, a hand under shell with lunar postfix (fig. 42,55), 19 times. In the last appearance of the glyph the lunar postfix is

TABLE 17—SCHEME OF THE VENUS CYCLE ON DRESDEN 46–50

Line	Cib	Cimi	Cib	Kan	Ahau	Oc	Ahau	Lamat	Kan	Ix	Kan	Eb	Lamat	Etz'nab	Lamat	Cib	Eb	Ik	Eb	Ahau
1	3	2	5	13	2	1	4	12	1	13	3	11	13	12	2	10	12	11	1	9
2	11	10	13	8	10	9	12	7	9	8	11	6	8	7	10	5	7	6	9	4
3	6	5	8	3	5	4	7	2	4	3	6	1	3	2	5	13	2	1	4	12
4	1	13	3	11	13	12	2	10	12	11	1	9	11	10	13	8	10	9	12	7
5	9	8	11	6	8	7	10	5	7	6	9	4	6	5	8	3	5	4	7	2
6	4	3	6	1	3	2	5	13	2	1	4	12	1	13	3	11	13	12	2	10
7	12	11	1	9	11	10	13	8	10	9	12	7	9	8	11	6	8	7	10	5
8	7	6	9	4	6	5	8	3	5	4	7	2	4	3	6	1	3	2	5	13
9	2	1	4	12	1	13	3	11	13	12	2	10	12	11	1	9	11	10	13	8
10	10	9	12	7	9	8	11	6	8	7	10	5	7	6	9	4	6	5	8	3
11	5	4	7	2	4	3	6	1	3	2	5	13	2	1	4	12	1	13	3	11
12	13	12	2	10	12	11	1	9	11	10	13	8	10	9	12	7	9	8	11	6
13	8	7	10	5	7	6	9	4	6	5	8	3	5	4	7	2	4	3	6	1
14	4	14	19	7	3	8	18	6	17	7	12	0	11	1	6	14	10	0	5	13
15	Yaxkin	Zac	Zec	Xul	Cumku	Zotz'	Pax	Kayab	Yax	Muan	Ch'en	Yax	Zip	Mol	Uo	Uo	Kankin	Uayeb	Mac	Mac
16	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.
17	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
18	Red ½	Red ½	Red ½	Red ½	Red	Red	Red	½	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus
19	236	326	576	584	820	910	1160	1168	1404	1494	1744	1752	1988	2078	2328	2336	2572	2662	2912	2920
20	8	18	4	12	3	13	18	6	2	7	17	5	16	6	11	19	15	0	10	18
	Zac	Muan	Yax	Yax	Zotz'	Mol	Uo	Zip	Muan	Pop	Mac	Kankin	Yaxkin	Ceh	Xul	Xul	Cumku	Zec	Kayab	Kayab
21	T	A	B	C	D	E	F	G	Winged	Winged	Winged	Winged	Wiuged	Winged	Winged	Winged		Winged	Winged	Winged
									Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chueu
22	Winged	Winged	Winged	Winged	..	..	..	..	H	I	J	K	L	M	N	O	P	Q	R	S
	Chuen	Chuen	Chuen	Chuen																
23	Red	Red	Red	Red	Red	Red	Red	Red	..	..	..	..	Red	Red	Red	Red	Red	Red	Red	Red
	Venus	Venus	Venus	Venus	Venus	Veuus	Venus	Venus					Venus	Venus	Venus	Venus	Venus	Veuus	Venus	Veuus
24	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.
25	19	4	14	2	13	3	8	16	7	17	2	10	6	16	1	9	0	10	15	3
	Kayab	Zotz'	Pax	Kayab	Yax	Muan	Ch'en	Ch'en	Zip	Yaxkin	Uo	Uo	Kankiu	Cumku	Mac	Mac	Yaxkin	Zac	Zec	Xul
26	236	90	250	8	236	90	250	8	236	90	250	8	236	90	250	8	236	90	250	8
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omitted (fig. 42,*56*). I think there can be little doubt that this is merely a completion sign, the lunar postfix being the rebus for the possessive *u* (p. 188).

Lines 18 and 23 are monotonously filled with Venus glyphs which, with one exception, have a red prefix. The single omission probably has no significance. On page 48, line 23 is omitted, presumably because of lack of space. A glyph resembling the Chuen sign but with various postfixes is repeated across the lower half of each page, except page 47, where its omission is presumably due to lack of space. It appears in lines 21 or 22 (fig. 42,*70,71*).

Line 14 gives the month positions corresponding to the 65 days recorded at the top. As the table extends horizontally for five Venus revolutions, which equal eight years of 365 days, the month positions follow in sequence, and each is used with all the 13 day signs above it. The table starts with 13 Mac, passes to 4 Yaxkin 236 days later, next to 14 Zac 90 days later, then to 19 Zec 250 days later, and reaches heliacal rising at 7 Xul. Passing through the various stages, heliacal risings are attained at 6 Kayab, 0 Yax, 14 Uo, and finally, once more, at 13 Mac. Thus, if 1 Ahau 13 Mac marks a heliacal rising, 9 Ahau 13 Mac will again be a heliacal rising, five revolutions later, to be followed after the same interval by 4 Ahau 13 Mac.

Lines 20 and 25 set forth two other sets of month positions, arranged in precisely the same way, but counted respectively from (1 Ahau) 18 Kayab and (1 Ahau) 3 Xul. The manner in which these two series may have been used will be reviewed later. The only major error in the table is 0 Xul instead of 0 Yaxkin (p. 50).

Line 16 gives the glyphs for the four world directions in the sequence east, north, west, south, with east corresponding to heliacal rising, so that page 46 starts with north assigned to the disappearance of Venus before superior conjunction, west appropriately to its reappearance as evening star, south to the day of its disappearance in the sun's rays four days before inferior conjunction, and east to its reappearance as morning star. The sequence then repeats on the following pages.

Line 24 repeats the world directions but in the sequence south, east, north, west, with south beneath the dates of heliacal risings after inferior conjunction. It will be recollected that whereas line 19 gives the accumulation of days, line 26 gives the intervals between the points in the synodical revolution. It is therefore probable that the first set of world directions refers to the actual dates of the synodical revolution of the planet; the second set gives the world directions of the intervals between those points. That is to say, heliacal rising after inferior conjunction is assigned to the east, and so, too, are the 236 days during which Venus is a morning star. The day of disappearance before superior conjunction is assigned to the north, and so are the 90 days of invisibility which follow. Heliacal rising after superior conjunction, when Venus becomes the evening star, is allotted to the west, as are the following 250 days during which the planet is visible in the west. Disappearance and the period of invisibility around inferior conjunction fall to the north.

Directional Gods in Venus Tables

Line 17 is occupied by the glyphs of 20 deities, some of whom are recognizable (fig. 42,*1–20*). These are lettered from A to T. The same series of glyphs, with immaterial variations, is repeated in lines 21 and 22 (the drop to line 22 on pp. 48–50 is due to the winged Chuen glyph being inserted above). However, the twentieth god of line 17 becomes the first god of lines 21 and 22, and the whole series is thereby moved forward a space. This displacement corresponds to the shift in the world-direction glyphs. God A is in the top line associated with the north and disappearance of Venus before superior conjunction; in the lower line he is assigned again to the north, but the association is, I hazard, with the 90 days of invisibility around superior conjunction.

Grouped by directions, these gods are:

East:

D. Almost certainly God A, god of death (fig. 42,*16*).

H. The tun sign in one line; the Cauac element in the other. The two glyphs are more or less synonymous. In both cases there is a coefficient of 4 and the same prefix. The latter glyph, but with a coefficient of 5, is that of God N, the old god. However, on Dresden 4a this same glyph with coefficient of 4 appears above a portrait of an aged god indistinguishable from God N. All in all, it is not unlikely that both glyphs represent God N, or a deity very closely connected with him (fig. 42,*17,22*).

L. The moon goddess, identifiable by the lunar postfix. Save for the two appearances in this table and a third appearance on page 24, which belongs to the ephemeris of Venus, this glyph occurs in only one other place in the codices. That is above one of the pictures in the eclipse tables of Dresden (fig. 42,*18*).

P. The Chicchan god with a coefficient of 1. The Chicchan, it will be recalled, is a celestial serpent (fig. 42,*19*).

T. A long-snouted monster with crossbands in the eye, and a death eye above the root of the snout. The crossbands are absent from the representation on page 24, and not recognizable on the glyph at the start of page 46 (fig. 42,*20*). With crossbands in the eye the glyph appears also in the eclipse tables (p. 56a). Its only other occurrence is on Madrid 71b, where, in a decidedly more conventionalized form, it accompanies one of the compartments of the sacred almanac, that starting with the day 3 Muluc.

These five glyphs follow one another in descending order in column B of Dresden 24a. That page, as already noted, is really a part of the Venus tables, and in the original pagination (p. 24) immediately preceded page 46. The glyphs, as arranged on page 24, take the order: H, L, P, T, D. That is the same as noted above save that D comes at the end of the series, not at the start.

North:

A. A geometric element above a bundle and with a *u* bracket as prefix. The central element has a death eye at top right, and in the center a motif which is similar to the closed eye with eyelashes of the death god (fig. 42,*1*). It is Gates' Glyph 344 and, as he has shown, is of frequent occurrence with varying affixes. Without the bundle it appears on all the Venus pages in apposition to other name glyphs of gods. Sometimes an object which looks like a rope crosses the glyph diagonally. It cannot be assigned to any known deity, although it would appear to represent some god of the underworld.

E. The head of a bird (?) with Etz'nab infix (fig. 42,*2*,*23*).

I. The glyph of the sun god; God G (fig. 42,*3*).

M. The head variant of the glyph of God B (fig. 42,*4*).

Q. The head of the maize god, God E. On page 24 the head of the maize god, but with a different prefix, appears in Column C (fig. 42,*5*,*28*).

West:

B. A glyph with a *te* (2) postfix and a prefix which is like that of white save for the addition of two antennae (fig. 42,*6*).

F. A deity with prominent lips and what is probably a death eye on his forehead. He wears a headdress which resembles the "Akbal" sign (fig. 42,*7*). Presumably a god of the underworld. This deity does not appear elsewhere in Dresden, but occurs a few times in Madrid with different affixes, and once with a coefficient of 9.

J. A symbolic glyph with a coefficient of 6. The glyph consists of a yax sign over a hand, like that of Manik (fig. 42,*8*). In the second example a "Ben-Ich" superfix is present. This glyph, in all cases with a coefficient of 6, occurs on Dresden 34c and on Paris 4, 9, and 10 in connection with the Katun regents. On the Santa Rita murals, again with coefficient of 6 and "Ben-Ich" prefix, it is attached to a deity resembling God D who is the regent of Tun 11 Ahau.

N. The head of the god of death with the *il* prefix and eye with loop in it (fig. 42,*9*).

R. The black-headed variant of God D. The black is surely added because the god here rules in the west, with which black is associated (fig. 42,*10*).

South: Inferior Conjunction → Collision

C. A head with the red prefix, an oval of dots around the mouth, peculiar curls at the corner of the eye and the Etz'nab sign on the side of the cheek (fig. 42,*11*). One would be inclined to identify this as the head of a deity of sacrifice. Xipe, it will be recalled, is the red god, the god of sacrifice. The head is not uncommon, with varying affixes, in Paris.

G. A composite glyph with a coefficient of 13. The top part of the first glyph is the sign for misfortune; the lower half the sky sign. There is a *te* (3) prefix (p. 285). The second glyph is precisely the same, save that the sky sign is above the misfortune element. The glyph vaguely suggests a deity of the 13 skies or the thirteenth layer of heaven (fig. 42,*12*,*21*).

K. The glyph is the "Akbal" over serpent scales with "Ben-Ich" prefix above, and another prefix to left (fig. 42,*13*). Could this mean something like night countenance (p. 201)?

O. A well-known head with two volutes emerging from an oval inserted in the forehead. It is the glyph of God K (fig. 42,*14*).

S. A symbolic glyph with a coefficient of 7. The main element resembles Mol, and there is a prefix like that of the month sign Cumku (fig. 42,*15*).

Although many of the deities to which these glyphs pertain cannot at present be identified, the listing of the glyphs by the directions with which they are associated may prove beneficial for later studies. I do not think they are directly associated with the planet Venus. The directional gods are in poor agreement with those given in Landa and on Dresden 25–28. God K is associated with the south on the Venus pages; with the east in the other two sources. The death god is associated with east and west on the Venus pages; with the south in the other two sources. The sun god and God D are associated with north and west, respectively, in all three sources (Thompson, 1934, p. 226).

Long Count Positions of Venus Tables

There are, as we have seen, three sets of month positions running through the Venus revolutions and clearly to be associated with the days given above.

These three sets of month positions end on 1 Ahau 18 Kayab, 1 Ahau 3 Xul, and 1 Ahau 13 Mac; what is undoubtedly the base for a fourth set, the date 1 Ahau 18 Uo, is given on page 24. It is pretty clear that they represent corrections to keep the Venus revolutions in step with the year of 365 days. After the table has been used once, that is to say after 65 synodical revolutions of Venus, the average appearance of the planet at heliacal rising will have dropped back slightly over five days ($65 \times 583.92 = 37954.8$; $104 \times 365 = 37,960$). Thus if heliacal rising fell on 1 Ahau 18 Kayab at the start of the table, it would be expected to fall on 9 Men 13 Kayab at the end, but because there is considerable variation in the length of a synodical revolution of Venus, one cannot say definitely that it would fall on that particular day. It is obvious that the table would accumulate a huge error if one waited until the sixty-fifth revolution fell on 1 Ahau 13 Mac, and a still greater error over thousands of years if one waited until it fell on 3 Xul. Teeple (1926) was the first to tackle this problem. He showed that if the Maya subtracted four days at the end of the sixty-first revolution of Venus, they would again reach 1 Ahau, but with a different month position. Similarly, as a correction of eight days occasionally had to be made, because the error was slightly over five days, not four, the subtraction of eight days at the end of the fifty-seventh revolution of the planet would also lead to 1 Ahau. These four bases would then be connected as follows:

1 Ahau 18 Kayab	
add 4.12. 8.0	57 revolutions of Venus less 8 days
1 Ahau 18 Uo	
add 4.18.17.0	61 revolutions of Venus less 4 days
1 Ahau 13 Mac	
add 4.18.17.0	61 revolutions of Venus less 4 days
1 Ahau 3 Xul	
add 4.18.17.0	61 revolutions of Venus less 4 days
(1 Ahau 8 Ch'en	not recorded)

The table can, of course, be extended indefinitely, with three corrections of four days at the end of 61 revolutions and one correction of eight days at the end of 57 revolutions. This correction of 20 days for 240 revolutions of the planet is remarkably accurate. The true correction should be 19.2 days, an error of less than a day in nearly 384 years.

This reconstruction was a brilliant piece of work on Teeple's part. It is moreover supported by the numbers on Dresden 24, which, as already noted, comes immediately before page 46, the break in the pagination being due to the incorrect arrangement made by Förstemann, and retained ever since.

The table on the right side of the page starts at the bottom right corner, and proceeds to the left and upwards, precisely the reverse of the way we write. Rearranged, with minor restorations and one change (260 days added to 9100), the material is presented in Table 18.

be a correction of about 25 days. If, however, the amended figure of 9360 days is subtracted from 185,120, the result (175,760 days) equals 301 revolutions of 584 days less 24 days, that is to say, four groups of 61 revolutions and one group of 57 revolutions. That is precisely how the correction should be made to achieve the greatest accuracy.

The figure 9360 is my own amendment, for the number is actually written as 9100 (1.5.5.0). However, there are good grounds for supposing that this is incorrect, for every other number of this table is either an exact multiple of 584, or a multiple of 584 with a small correction which is a multiple of 4, made in such a way that the total is a multiple of 260. The figure 9100 is 15×584+340, and, therefore, is far removed from any multiple of 584. In two or three cases in the tables of Dresden there are apparent mistakes which can best be corrected by the addition or subtraction of 260 days. If 260 is subtracted from 9100, the remainder still fails to approximate

TABLE 18—MULTIPLES OF VENUS REVOLUTIONS ON DRESDEN 24

Maya	Day	Days	Revolutions of Venus	
8 . 2 . 0	9 Ahau	2920	5	
16 . 4 . 0	4 Ahau	5840	10	
1 . 4 . 6 . 0	12 Ahau	8760	15	
1 . 12 . 8 . 0	7 Ahau	11680	20	(3 dots restored in uinal coefficient)
2 . 0 . 10 . 0	2 Ahau	14600	25	
2 . 8 . 12 . 0	10 Ahau	17520	30	
2 . 16 . 14 . 0	5 Ahau	20440	35	
3 . 4 . 16 . 0	13 Ahau	23360	40	
3 . 13 . 0 . 0	8 Ahau	26280	45	
4 . 1 . 2 . 0	3 Ahau	29200	50	
4 . 9 . 4 . 0	11 Ahau	32120	55	
4 . 17 . 6 . 0	6 Ahau	35040	60	
1 . 6 . 0 . 0	1 Ahau	9360	16	plus 16 days (260 days added)
4 . 12 . 8 . 0	1 Ahau	33280	57	minus 8 days
9 . 11 . 7 . 0	1 Ahau	68900	118	minus 12 days
1 . 5 . 14 . 4 . 0	1 Ahau	185120	317	minus 8 days
(5).(5). 8 . 0	1 Ahau	37960	65	
(10).(10). 16 . 0	1 Ahau	75920	130	
(15).(16). 6 . 0	1 Ahau	113880	195	
(1).(1). 1 . 14 . 0	1 Ahau	151840	260	

The figures in the table are regular multiples of the group of five revolutions of Venus (2920=8×365) with the exception of those in the fourth row. These embody the corrections employed. The 57 revolutions minus 8 days lead from 1 Ahau 18 Kayab to the base 1 Ahau 18 Uo, given at the bottom of this page; the 118 revolutions minus 12 days carry the reckoning from 1 Ahau 18 Kayab to 1 Ahau 13 Mac (57 revolutions with a correction of 8 days plus 61 revolutions with a correction of 4 days).

The figure of 185,120 represents 317 (260 + 57) revolutions less 8 days, but after 317 revolutions there should

a multiple of 584, but if 260 is added, the new figure of 9360 is 16×584+16, the remainder being, as required, a multiple of 4. I shall revert to the discussion of this number.

The question next arises as to what positions in the LC were occupied by these bases. On the left of page 24 there are two IS with the distance number that separates them, expressed as a ring number, that is to say, part of it is encircled.

9.9.16. 0.0	4 Ahau 8 Cumku
6. 2.0	
9.9. 9.16.0	1 Ahau 18 Kayab

This means that to a base 6.2.0. before 13.0.0.0.0 4 Ahau 8 Cumku the number 9.9.16.0.0 is added to reach 9.9.9.16.0 1 Ahau 18 Kayab.

The first number is 72 CR, which are equal to 2340 uncorrected synodical revolutions of the planet. During that interval Venus would have moved forward until heliacal risings would be 184 days earlier in the year (24 days correction for 301 Venus revolutions). The accumulated error of 184 days is very close to half a year, but that may be coincidence.

In no correlation so far suggested which is not derived solely from astronomical data does 9.9.9.16.0 coincide with a heliacal rising of Venus after inferior conjunction. In the Goodman-Thompson correlation heliacal rising occurs at about 9.9.9.16.16, that is to say about 16 days later. This error of some 16 days immediately reminds one of the corrected number 9360 days in the table, which equals 16 Venus revolutions and 16 days. If that is added to 9.9.9.16.0 1 Ahau 18 Kayab, one gets a new and correct base for the table, to which groupings of 57 and 61 Venus revolutions can be added as shown below:

A	9. 9. 9.16.0	1 Ahau	18 Kayab
A′	1. 6. 0.0	16 V. R. +	16 days
B	9.10.15.16.0	1 Ahau	8 Zac.
B′	4.18.17.0	61 V. R. −	4 days
C	9.15.14.15.0	1 Ahau	18 Zip
C′	4.18.17.0	61 V. R. −	4 days
D	10. 0.13.14.0	1 Ahau	13 Kankin
D′	4.18.17.0	61 V. R. −	4 days
E	10. 5.12.13.0	1 Ahau	3 Yaxkin
E′	4.18.17.0	61 V. R. −	4 days
F	10.10.11.12.0	1 Ahau	18 Kayab
F′	4.12. 8.0	57 V. R. −	8 days
G	10.15. 4. 2.0	1 Ahau	18 Uo
G′	4.18.17.0	61 V. R. −	4 days
H	11. 0. 3. 1.0	1 Ahau	13 Mac
H′	4.18.17.0	61 V. R. −	4 days
I	11. 5. 2. 0.0.	1 Ahau	3 Xul

It will be seen that this table embodies all four of the corrections given in the third row of page 24:

9360 (as amended)	is $16 \times 584 - 16 =$ A′
33280	is $57 \times 584 - 8 =$ F′
68900	is $118 \times 584 - 12 =$ F to H or E to G
185120	is $317 \times 584 - 8 =$ A to G

One may also note, although it may be pure coincidence, that the highest figure in the table clearly restorable as 1.1.1.14.0 (151,840) is the distance between the two positions of 1 Ahau 18 Kayab (A and F).

The positions which end the tables in the codex are 1 Ahau 18 Kayab (A and F), 1 Ahau 13 Mac (H), and 1 Ahau 3 Xul (I), while 1 Ahau 18 Uo (G) is given on page 24.

This, of course, is not the only reconstruction that can be made, but it fits the 11.16.0.0.0 correlation, and it satisfactorily explains the large correction of 317 Venus years minus eight days. One would normally expect 301 Venus years minus 24 days. The drawback to the solution offered is that the bases 1 Ahau 8 Zac, 1 Ahau 18 Zip, 1 Ahau 13 Kankin, and 1 Ahau 3 Yaxkin, are nowhere written. The explanation of this probably lies in the fact that those bases were far in the past when the present edition of Dresden was written. Probably the 1 Ahau 18 Uo base was current when the present edition was produced. The Maya astronomer, accordingly, gave the old base, and with the correction of 185,120 days reached the base then current, and added those which would follow, 1 Ahau 13 Mac and 1 Ahau 3 Xul.

There remains unexplained the reason why a base 9.9.9.16.0 1 Ahau 18 Kayab, with a positive error of some 16 days, was chosen. There are several factors which may have led to its choice. Mrs. Makemson (1943, p. 214) has pointed out that the planet Mars is probably involved. She has shown that the Mars revolution of 780 days is a factor, and also that 9.9.9.16.0 1 Ahau 18 Kayab was just three days before conjunction of Mars with the sun. The synodical revolution of Mars is 779.936 days. The number 780 was therefore a very close approximation, and had the tremendous advantage in Maya eyes that it was a multiple of 260. Thereby the uncorrected Mars cycle would always fall on the same day. A point perhaps of some importance is that with the return of 1 Ahau at the end of each group of 65 uncorrected revolutions of Venus, the lord of the night will be different; only after the 65-year cycle has repeated nine times will the same lord of the night return to power. That is to say, only at the end of 585 uncorrected Venus years will the theoretical date of heliacal rising both fall on 1 Ahau and have the same lord of the night regnant. The interval 9.9.16.0.0, equivalent of 2340 uncorrected Venus years, being four times the lowest common factor, reproduces this condition.

The interval 9.9.16.0.0, accordingly, has a number of properties which gave it importance in Maya eyes. It is the equivalent of: 1,366560 DAYS

2340	uncorrected revolutions of Venus (584 days)
3744	uncorrected years of 365 days
5256	cycles of 260 days
1752	uncorrected revolutions of Mars (780 days)
3796	tuns (360 days)
4	Venus great cycles with same lord of night (341,640 days)

Perhaps the corrections applied to the Venus calendar prior to 9.10.0.0.0 were too great, with the result that the calendar showed a heliacal rising of Venus at 9.9.9.16.0, whereas it actually took place 16–18 days later. Accordingly the uncorrected date for Venus was first given, and then this was corrected by the addition of 16 Venus revolutions and 16 days. This number of Venus revolutions was chosen because it was the only one which with the addition of 16 days once more brought heliacal rising back to the desired base of 1 Ahau. It also had the property of being equal to 12 synodical revolutions of Mars. The Maya could therefore say: "Mars was in conjunction with the sun at 9.9.9.16.0, when Venus should have been at heliacal rising after inferior conjunction. However, our calculations have been in error. The new base is 9.10.15.16.0 1 Ahau 8 Zac. On that date Mars will again be very near conjunction with the sun, and on the same day there will be a heliacal rising of Venus."

Because of variation in the length of the synodical revolutions of Venus, it would be difficult at first to approximate the true correction. Assume, for instance, that the Maya correction was originally made by dropping 12 days at the end of every 118 Venus revolutions, as given in the list of corrections on page 24. This would have been too much by 2.56 days, and the positive error of some 16 days would have accumulated in about three baktuns. On the other hand, it is possible that there was a shift from heliacal setting to heliacal rising at 9.9.9.16.0. The total error in that case would be only some eight days, and would have accumulated with the same overcorrection in about 30 katuns.

The possibility that the Venus cycle was once counted not from heliacal rising, but from heliacal setting eight days before should not be disregarded. The arrangement of the tables in the present edition of Dresden makes it abundantly clear that the reckoning was then from heliacal rising after inferior conjunction, but it does not necessarily follow that that arrangement had always been in force. The position 1 Ahau and the day Lamat are closely associated with the planet. If heliacal setting was on a day Ahau, heliacal rising would occur eight days later on Lamat. Furthermore, disappearance of the planet seems a trifle more logical as the point to complete the revolution than does the day of reappearance.

These tables demonstrate how accurately the Maya reckoned the synodical revolutions of Venus. With the correction of four days at the end of 61 revolutions repeated four times, and then a correction of eight days at the end of the 57 revolutions they attained a rare precision. For this is a correction of 24 days in 301 revolutions (approximately 480 years), whereas the accumulated error would in reality have been 24.08 days. The tables also demonstrate how important it was to the Maya to associate their various cycles with the sacred almanac so as to find when together they would reach the same *lub*. In the case of the uncorrected revolution of Venus that was a relatively simple matter, for 65 revolutions of Venus equaled 146 cycles of 260 days, but the corrections had to be made so as to retain that association. This could be achieved only by corrections of four days and its multiples. It was for that reason that a correction of four days was made at the end of 61 revolutions, although a reduction of five days was called for; with an adjustment of five days it would have been impossible to retain 1 Ahau as the base, but that was essential.

The elucidation of the Venus tables illustrates well how one student after the other has taken up the torch of research. Förstemann, Seler, Willson, Teeple, Makemson, Long and I have contributed in varying degree to our present appreciation of this beautiful and subtle product of Maya mentality. Satterthwaite (1947) has shown how the Venus tables are very handy for calculation.