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70. The Maya and Christian Eras

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Central America : Chronology.

Long.

The Maya and Christian Eras. By Richard C. E. Long.

70

The method by which the Mayas reckoned time from the zero point of their chronology is now well established, and may be found fully set out in the works of Mr. C. P. Bowditch (*The Numeration, Calendar System, and Astronomical Knowledge of the Mayas*, Cambridge, Mass, 1910) and Mr. S. G. Morley (*An Introduction to the Study of the Maya Hieroglyphs*, Washington, 1915). It is sufficient here to recall that the units of time used are the day or *kin*, the *uinal* of twenty days, the *tun* of eighteen *uinals*, the *katun* of twenty *tuns*, and the cycle of twenty *katuns*. In this paper the usual method of writing these periods will be used, by which, *e.g.*, nine cycles, sixteen *katuns*, four *tuns*, eleven *uinals*, and eight-*kins* are written 9-16-4-11-8. It will be assumed here that the higher units above the cycle follow the vigesimal scale, so that, *e.g.*, 2-4-0-0-0 reads as two great cycles (each containing twenty cycles) and four cycles. Many different suggestions have been made to determine the date in the Christian era corresponding to the date 4 Ahau 8 Cumhu, the zero point of the Long Count.

Mr. Bowditch (*American Anthropologist*, N.S. III, No. 1, 1901) by calculating from the date 11th September 1536 reaches a result by which this latter date would in the Long Count (taking above value of the great cycle) be 13-2-13-3-1, 9 Imix 19 Zip. Mr. T. A. Joyce (*Mexican Archaeology*, London, 1914) does not go into the calculation from this date, but compares the Short Count dates of the Books of Chilán Balam with the Long Count, and reaches a result which would give exactly the same date. The important point is that these writers reach the same result by different methods. Neither of them had occasion to work out the exact days of the month and exact year in the Christian era corresponding to other Maya dates. Mr. Bowditch uses the "vague" year of 365 days instead of the Julian or Gregorian year to convert the Long Count dates to dates in the Christian era, and the dates given in the appendix to Mr. Joyce's book are also approximate. Assuming that 11th September 1536 was 13-2-13-3-1 in the Long Count, and also assuming, in accordance with the opinion of Mr. Bowditch and Mr. Morley, that the Mayas made no intercalation in their calendar, but used only a vague year of 365 days, which consequently shifted round by one whole vague year in 1461 years, I have calculated in annexed table the exact dates of each cycle date up to cycle 8 and of each *katun* date from that to *katun* 2 of cycle 14. No "historical" dates are found before cycle 8, so it is unnecessary to give each *katun* of earlier cycles.

The series has been brought up to date, as the books of Chilán Balam carry on the Short Count into the 18th century. The Julian calendar has been used throughout, as it was in use during the existence of the Maya reckoning, and is also more convenient for calculation.

Now the remarkable fact emerges that by such a calculation the date 9-9-16-0-0, 4 Ahau 8 Cumhu, fell upon 21 June, A.D. 100, that is, on the summer solstice, because in A.D. 100 the Julian calendar was at most not more than a day in error. Dr. Forstemann has shown the prominence of this date in the Dresden Codex, and that it seems to be the date which all the other dates in the Codex lead up to. The number 9-9-16-0-0 contains as factors most of the important numbers in the Maya calendar, and has the especially important property that after the lapse of this time the *tun*, the calendar round, and the Venus cycle of 104 years all coincide.

This throws some light on the nature of the date of the zero point of the Long Count, which also fell on a date 4 Ahau 8 Cumhu. Mr. Morley (*op. cit.*, p. 60) has shown good reasons for believing that this zero point was not a real historical

date from which the Mayas commenced reckoning, but rather a date chosen for the zero point of the era very long afterwards. It seems difficult to resist his conclusion, seeing that, with certain exceptions which can be otherwise explained, no objects are found dated in the first seven cycles, and the monuments only commence in cycle 9.

I suggest, then, that the mythical zero point, 4 Ahau 8 Cumhu, was obtained by calculating back from 9-9-16-0-0, 4 Ahau 8 Cumhu, which latter date fell some time after the calculation was made. The reason for counting back the distance number, 9-9-16-0-0, was owing to the remarkable properties of this number, and as to the reason for selecting the date, 9-9-16-0-0, 4 Ahau 8 Cumhu, to count back from, there are two suggestions possible :

(1) This date was one on which the summer solstice fell on the day Ahau, the most important of the twenty days of the *uinal*. If we take the tropical year to be $365\frac{1}{4}$ days, which for short periods is sufficiently accurate, it can be shown that the summer solstice would not again fall on Ahau till after nineteen years if the previous occurrence was in an ordinary year, or twenty-three years if it was in a leap year, so that the choice of days Ahau which are also days of the summer solstice is limited. Further, it would be natural to select such a day falling in the month Cumhu, the last month of the year, following the general Maya principle of reckoning from the ends of periods. If this last be granted it will be found that the choice of dates is practically limited to four, viz., 6 Ahau 3 Cumhu (nineteen years before 4 Ahau 8 Cumhu), the date 4 Ahau 8 Cumhu itself, 6 Ahau 13 Cumhu (twenty-three years after 4 Ahau 8 Cumhu, because A.D. 100 was a leap year), and 4 Ahau 18 Cumhu (nineteen years after 6 Ahau 13 Cumhu). Any earlier or later date would fall outside of the month Cumhu, and the solstice would not again fall in Cumhu for a very long period of time.

(2) The foregoing suggestion only presupposes that the Mayas, previous to making this calculation, only used their 365-day year and the calendar round of 52 years, and no additional fixed time period. But if we suppose that besides the year of 365 days they also used the year of 360 days, the *tun*, not merely as a counter but as a fixed period with its own recurring New Years Day, concurrently with the 365-day year, it will be found that the solstice would not again fall on a day Ahau which was also the last day of a *tun* for a very long period, and that neither its next nor its previous occurrence on Ahau would fall in Cumhu. It would not fall again on Ahau in Cumhu within a cycle either before or after. Therefore, on this supposition there is no choice of any other day within the limits of "historical" Maya dates.

It is clear that the choice of the date 9-9-16-0-0, 4 Ahau 8 Cumhu, to reckon back from must have been made while the date itself was still in the future, because there are many "historical" Maya dates much earlier in cycle 9, and probably the cycle 8 dates are also "historical." The objection will at once be made that the Mayas could not have known beforehand that the summer solstice would fall on this date. I do not, however, think that this objection has any weight. Mr. Bowditch has shown that the Mayas seem to have been skilful enough to have calculated the true length of the tropical year very closely while leaving their shifting calendar undisturbed, and Mr. Morley agrees with him. They appear to have allowed for a shift of 25 days in 104 years, which is an error of less than a day in 400 years, and so if they had made the calculation during cycle 8, say 400 and odd years previously, they would have come within a day of the true time. The foregoing consideration may therefore be taken to be an independent confirmation of the correctness of the correlation of Maya and Christian chronology arrived at by Mr. Bowditch and Mr. Joyce.

I now come to a matter which is far more conjectural. If the same calculation is applied to the date 9-9-9-16-0, 1 Ahau 18 Kayab, found on p. 24 of the Dresden Codex, it is found to be 13 June 94 A.D. Now, this date appears to be connected with the Venus cycle occurring on the right of the same page, and on p. 50 the same date is made the end of the series relating to the synodic revolution of Venus, and as it there follows immediately after the distance number of eight days, the length of time in which Venus is invisible at inferior conjunction, it would appear that the conjunction took place shortly before this time. If we assume that the initial series value of this date on p. 50 is the same as that of the same date on p. 24, it would follow that there should have been an inferior conjunction of Venus on or shortly before 13 June 94 A.D. I have no means of verifying this, which is properly a matter for a skilled astronomer to compute, but it is worthy of note that if we calculate back from the transit of Venus of 23 May 1769 (Julian) to 13 June 94 A.D., by dividing the number of days distance between the dates, 611,771 by 583·92, the number of days in a synodic period of Venus, we obtain a remainder of 406·76. Therefore, by this calculation there was a conjunction 406·76 days after 13 June 94, or 177·16 days before it, because 177·16 is the difference between 406·76 and 583·92. Neglecting fractions, there remain 177 days, which is the number given on p. 53a of the Codex for the length of six lunar months. Possibly the intention was to record a date which, according to the calendar, should be the date of a conjunction, but was really six lunar months in error.

There is, however, a more probable explanation. Mrs. Zelia Nuttall (*American Anthropologist*, Vol. 6, No. 4, 1904), has shown that the Venus cycle of 104 years (equal to two calendar rounds) is about five days longer than the true time. This being so, the error in 9-9-16-0-0 (72 calendar rounds) would be $36 \times 5 = 180$ days, very nearly the 177 days, and the error in 9-9-9-16-0 would be practically the same. If then an inferior conjunction of Venus did in fact occur 177 or 180 days before 13 June 94 A.D., there would have been an excellent reason for the Mayas to record specially this date, if on it their official Venus calendar was 180 days too late, that being the number of days required to correct the Venus calendar since the mythical zero point, 4 Ahau 8 Cumhu, if they used a correction of five days to each Venus cycle, and also being half the number of days in a *tun*. It would be parallel to the instances shown by Mr. Bowditch of the record of dates on which the solar calendar was a definite amount in error. Considering the wonderful astronomical knowledge of the Mayas, we may be fairly certain that they noticed the error of their Venus calendar, and used a correction. If the date 9-9-9-16-0, 1 Ahau 18 Kayab, has this meaning, the calculation of the amount of the error of the Venus cycle must have been made while that date was still in the future, and in fact, it must have been made at the same time as the calculation relating to the date 9-9-16-0-0 4, Ahau 8 Cumhu. This would make it all the more probable that the calculated error was 180 days, while the true error on the former of these dates was 177 days or less. It is to be noted that on p. 24 of the Codex these two dates are connected by the secondary series 6-2-0, as if to connect the Venus and solar computation.

If the theory put forward in this paper as to the origin of the zero point of Maya chronology is sound, it will show a remarkable parallel to the Hindu Kali Yuga era of 3102 B.C., which has been shown also not to be a historical date, but one arrived at by calculating back till a date was reached which would be the commencement of a cycle harmonising lesser cycles (Dr. J. F. Fleet, in *Journ. Roy. Asiatic Soc.*, April, 1911). It is curious that another parallel can be found between the Hindu method of reckoning by "expired" instead of current time periods and the Maya reckoning by elapsed time.

TABLE OF MAYA DATES WITH EQUIVALENTS IN JULIAN CALENDAR.

							B.C.
The normal date or zero point-	4	Ahau	8	Cumhu	-	-	13 January 3642
1- 0-0-0-0 - - -	3	„	13	Chen	-	-	14 April 3248
2- 0-0-0-0 - - -	2	„	3	Uayeb	-	-	15 July 2854
3- 0-0-0-0 - - -	1	„	8	Yax	-	-	14 October 2460
4- 0-0-0-0 - - -	13	„	13	Pop	-	-	14 January 2065
5- 0-0-0-0 - - -	12	„	3	Zac	-	-	15 April 1671
6- 0-0-0-0 - - -	11	„	8	Uo	-	-	15 July 1277
7- 0-0-0-0 - - -	10	„	3	Zac	-	-	15 October 883
8- 0-0-0-0 - - -	9	„	3	Zip	-	-	14 January 488
8- 1-0-0-0 - - -	7	„	8	Pax	-	-	1 October 469
8- 2-0-0-0 - - -	5	„	8	Zac	-	-	18 June 449
8- 3-0-0-0 - - -	3	„	8	Xul	-	-	5 March 429
8- 4-0-0-0 - - -	1	„	8	Pop	-	-	21 November 410
8- 5-0-0-0 - - -	12	„	13	Kankin	-	-	8 August 390
8- 6-0-0-0 - - -	10	„	13	Chen	-	-	25 April 370
8- 7-0-0-0 - - -	8	„	13	Zodz	-	-	10 January 350
8- 8-0-0-0 - - -	6	„	18	Kayab	-	-	27 September 331
8- 9-0-0-0 - - -	4	„	18	Ceh	-	-	14 June 311
8-10-0-0-0 - - -	2	„	18	Yaxkin	-	-	1 March 291
8-11-0-0-0 - - -	13	„	18	Uo	-	-	16 November 272
8-12-0-0-0 - - -	11	„	3	Pax	-	-	3 August 252
8-13-0-0-0 - - -	9	„	3	Zac	-	-	20 April 232
8-14-0-0-0 - - -	7	„	3	Xul	-	-	5 January 212
8-15-0-0-0 - - -	5	„	3	Pop	-	-	22 September 193
8-16-0-0-0 - - -	3	„	8	Kankin	-	-	9 June 173
8-17-0-0-0 - - -	1	„	8	Chen	-	-	25 February 153
8-18-0-0-0 - - -	12	„	8	Zodz	-	-	12 November 134
8-19-0-0-0 - - -	10	„	13	Kayab	-	-	30 July 114
9- 0-0-0-0 - - -	8	„	13	Ceh	-	-	16 April 94
9- 1-0-0-0 - - -	6	„	13	Yaxkin	-	-	1 January 74
9- 2-0-0-0 - - -	4	„	13	Uo	-	-	18 September 55
9- 3-0-0-0 - - -	2	„	18	Moan	-	-	5 June 35
9- 4-0-0-0 - - -	13	„	18	Yax	-	-	20 February 15
							A.D.
9- 5-0-0-0 - - -	11	„	18	Tzec	-	-	7 November 5
9- 6-0-0-0 - - -	9	„	3	Uayeb	-	-	25 July 25
9- 7-0-0-0 - - -	7	„	3	Kankin	-	-	11 April 45
9- 8-0-0-0 - - -	5	„	3	Chen	-	-	27 December 64
9- 9-0-0-0 - - -	3	„	3	Zodz	-	-	13 September 84
9-10-0-0-0 - - -	1	„	8	Kayab	-	-	31 May 104
9-11-0-0-0 - - -	12	„	8	Ceh	-	-	16 February 124
9-12-0-0-0 - - -	10	„	8	Yaxkin	-	-	3 November 143
9-13-0-0-0 - - -	8	„	8	Uo	-	-	21 July 163
9-14-0-0-0 - - -	6	„	13	Moan	-	-	7 April 183
9-15-0-0-0 - - -	4	„	13	Yax	-	-	23 December 202
9-16-0-0-0 - - -	2	„	13	Tzec	-	-	9 September 222
9-17-0-0-0 - - -	13	„	18	Cumhu	-	-	27 May 242
9-18-0-0-0 - - -	11	„	18	Mac	-	-	11 February 262
9-19-0-0-0 - - -	9	„	18	Mol	-	-	29 October 281
10- 0-0-0-0 - - -	7	„	18	Zip	-	-	16 July 301

										A.D.
10-	1-0-0-0	-	-	-	5	Ahau	3	Kayab	-	2 April 321
10-	2-0-0-0	-	-	-	3	"	3	Ceh	-	18 December 340
10-	3-0-0-0	-	-	-	1	"	3	Yaxkin	-	4 September 360
10-	4-0-0-0	-	-	-	12	"	3	Uo	-	22 May 380
10-	5-0-0-0	-	-	-	10	"	8	Moan	-	7 February 400
10-	6-0-0-0	-	-	-	8	"	8	Yax	-	25 October 419
10-	7-0-0-0	-	-	-	6	"	8	Tzec	-	14 July 439
10-	8-0-0-0	-	-	-	4	"	13	Cumhu	-	29 March 459
10-	9-0-0-0	-	-	-	2	"	13	Mac	-	14 December 478
10-	10-0-0-0	-	-	-	13	"	13	Mol	-	31 August 498
10-	11-0-0-0	-	-	-	11	"	13	Zip	-	18 May 518
10-	12-0-0-0	-	-	-	9	"	18	Pax	-	2 February 538
10-	13-0-0-0	-	-	-	7	"	18	Zac	-	20 October 557
10-	14-0-0-0	-	-	-	5	"	18	Xul	-	7 July 577
10-	15-0-0-0	-	-	-	3	"	18	Pop	-	24 March 597
10-	16-0-0-0	-	-	-	1	"	3	Moan	-	9 December 616
10-	17-0-0-0	-	-	-	12	"	3	Yax	-	26 August 636
10-	18-0-0-0	-	-	-	10	"	3	Tzec	-	13 May 656
10-	19-0-0-0	-	-	-	8	"	8	Cumhu	-	29 January 676
11-	0-0-0-0	-	-	-	6	"	8	Mac	-	16 October 695
11-	1-0-0-0	-	-	-	4	"	8	Mol	-	3 July 715
11-	2-0-0-0	-	-	-	2	"	8	Zip	-	20 May 735
11-	3-0-0-0	-	-	-	13	"	13	Pax	-	5 December 754
11-	4-0-0-0	-	-	-	11	"	13	Zac	-	22 August 774
11-	5-0-0-0	-	-	-	9	"	13	Xul	-	9 May 794
11-	6-0-0-0	-	-	-	7	"	13	Pop	-	24 January 814
11-	7-0-0-0	-	-	-	5	"	18	Kankin	-	11 October 833
11-	8-0-0-0	-	-	-	3	"	18	Chen	-	28 June 853
11-	9-0-0-0	-	-	-	1	"	18	Zodz	-	15 March 873
11-	10-0-0-0	-	-	-	12	"	3	Cumhu	-	30 November 892
11-	11-0-0-0	-	-	-	10	"	3	Mac	-	17 August 912
11-	12-0-0-0	-	-	-	8	"	3	Mol	-	4 May 932
11-	13-0-0-0	-	-	-	6	"	3	Zip	-	20 January 952
11-	14-0-0-0	-	-	-	4	"	8	Pax	-	7 October 971
11-	15-0-0-0	-	-	-	2	"	8	Zac	-	24 June 991
11-	16-0-0-0	-	-	-	13	"	8	Xul	-	11 March 1011
11-	17-0-0-0	-	-	-	11	"	8	Pop	-	26 November 1030
11-	18-0-0-0	-	-	-	9	"	13	Kankin	-	13 August 1050
11-	19-0-0-0	-	-	-	7	"	13	Chen	-	30 April 1070
12-	0-0-0-0	-	-	-	5	"	13	Zodz	-	15 January 1090
12-	1-0-0-0	-	-	-	3	"	18	Kayab	-	2 October 1109
12-	2-0-0-0	-	-	-	1	"	18	Ceh	-	19 June 1129
12-	3-0-0-0	-	-	-	12	"	18	Yaxkin	-	6 March 1149
12-	4-0-0-0	-	-	-	10	"	18	Uo	-	21 November 1168
12-	5-0-0-0	-	-	-	8	"	3	Pax	-	8 August 1188
12-	6-0-0-0	-	-	-	6	"	3	Zac	-	25 April 1208
12-	7-0-0-0	-	-	-	4	"	3	Xul	-	10 January 1228
12-	8-0-0-0	-	-	-	2	"	3	Pop	-	28 September 1247
12-	9-0-0-0	-	-	-	13	"	8	Kankin	-	15 June 1267
12-	10-0-0-0	-	-	-	11	"	8	Chen	-	2 March 1287
12-	11-0-0-0	-	-	-	9	"	8	Zodz	-	17 November 1306

A.D.

12-12-0-0-0	-	-	-	7	Ahau	13	Kayab	-	-	4	August	1326
12-13-0-0-0	-	-	-	5	„	13	Ceh	-	-	21	April	1346
12-14-0-0-0	-	-	-	3	„	13	Yaxkin	-	-	6	January	1366
12-15-0-0-0	-	-	-	1	„	13	Uo	-	-	23	September	1385
12-16-0-0-0	-	-	-	12	„	18	Moan	-	-	10	June	1405
12-17-0-0-0	-	-	-	10	„	18	Yax	-	-	25	February	1425
12-18-0-0-0	-	-	-	8	„	18	Tzec	-	-	12	November	1444
12-19-0-0-0	-	-	-	6	„	3	Uayeb	-	-	30	July	1464
13- 0-0-0-0	-	-	-	4	„	3	Kankin	-	-	16	April	1484
13- 1-0-0-0	-	-	-	2	„	3	Chen	-	-	2	January	1504
13- 2-0-0-0	-	-	-	13	„	3	Zodz	-	-	19	September	1523
13- 3-0-0-0	-	-	-	11	„	8	Kayab	-	-	6	June	1543
13- 4-0-0-0	-	-	-	9	„	8	Ceh	-	-	21	February	1563
13- 5-0-0-0	-	-	-	7	„	8	Yaxkin	-	-	8	November	1582
13- 6-0-0-0	-	-	-	5	„	8	Uo	-	-	26	July	1602
13- 7-0-0-0	-	-	-	3	„	13	Moan	-	..	12	April	1622
13- 8-0-0-0	-	-	-	1	„	13	Yax	-	-	28	December	1641
13- 9-0-0-0	-	-	-	12	„	13	Tzec	-	-	14	September	1661
13-10-0-0-0	-	-	-	10	„	18	Cumhu	-	-	1	June	1681
13-11-0-0-0	-	-	-	8	„	18	Mac	-	-	16	February	1701
13-12-0-0-0	-	-	-	6	„	18	Mol	-	-	3	November	1720
13 13-0-0-0	-	-	-	4	„	18	Zip	-	-	21	July	1740
13-14-0-0-0	-	-	-	2	„	3	Kayab	-	-	7	April	1760
13-15-0-0-0	-	-	-	13	„	3	Ceh	-	-	24	December	1779
13-16-0-0-0	-	-	-	11	„	3	Yaxkin	-	-	10	September	1799
13-17-0-0-0	-	-	-	9	„	3	Uo	-	-	28	May	1819
13-18-0-0-0	-	-	-	7	„	8	Moan	-	-	12	February	1839
13-19-0-0-0	-	-	-	5	„	8	Yax	-	-	30	October	1858
14- 0-0-0-0	-	-	-	3	„	8	Tzec	-	-	17	July	1878
14- 1-0-0-0	-	-	-	1	„	13	Cumhu	-	-	3	April	1898
14- 2-0-0-0	-	-	-	12	„	13	Mac	-	-	19	December	1917

RICHARD C. E. LONG.

REVIEW.

History.

Rawlinson.

Intercourse between India and the Western World, from the Earliest Times to the Fall of Rome. By H. G. Rawlinson, M.A., I.E.S. Cambridge University Press. 1916.

Mr. Rawlinson is already well known to Orientalists by his work on *Bactria* and other essays. He has now attempted a more difficult task, a consecutive survey of the intercourse between India and the West in ancient times, up to the fall of the Roman Empire. As far as it is possible to ascertain, no work based on recent authorities has dealt with this subject as a whole, although parts of it have been investigated from time to time. Yet it is of the greatest importance to the civilised world; now as of old the control, both military and economical, of the trade-routes between Europe and the East is the subject of contest, and the rivalry between land and sea-routes is no less keen than it was in the days of Solomon, of Alexander, or of Albuquerque.