Appendix IV

Maya Calculations Far into the Past and into the Future

Picked from the worm holes of long-vanish'd days.
—Shakespeare, *Henry V*, Act II

It seems advisable to gather the most outstanding of Maya calculations into the past and into the future in order to illustrate how the Maya thought in vast expanses of time, and how they handled those great distances. It must be confessed that the Maya did not make those tremendous calculations without occasional mistakes, but they did calculate a date over 500,000,000 years in the past without error, a truly remarkable achievement.

For the sake of simplicity, I shall use the terms derived from Beltran to distinguish the higher periods, namely:

1 pictun	= 20 baktuns	(8,000 tuns)
1 calabtun	= 20 pictuns	(160,000 tuns)
1 kinchiltun	= 20 calabtuns	(3,200,000 tuns)
1 alautun	= 20 kinchiltuns	(64,000,000 tuns)

It should be remembered, however, that there is no direct evidence for the use of these compounds. They have been employed by Morley, Spinden and others, and thus have been legitimized, so to speak, by use.

One of the most interesting of the calculations into the past occurs on the Tablet of the Inscriptions, Palenque. It was Richard C. E. Long (1923) who first solved this equation by reading the tun coefficient as 2 instead of 1. With that change he was able to connect the dates satisfactorily:

1.13. 0. 9. 9. 2. 4.8	5 Lamat 1 Mol
7.18. 2. 9. 2.12.1	*Subtract*
(1. 5. 2.)6.19.19.10.7	1 Manik 10 Zec

The coefficients of the two highest periods of the first date have been supplied from a possible arrangement of the inscription on Tikal 10. The calculation here covers 1,264,982 tuns, a little short of 1,250,000 years.

On this same tablet there is a calculation into the future which leads to the end of the current pictun:

(1.13. 0.) 9. 8. 9.13.0	8 Ahau 13 Pop
10.11.10. 5.8	*Add*
(1.13.)1. 0. 0. 0. 0.8	5 Lamat 1 Mol
8	*Subtract*
(1.13.)1. 0. 0. 0. 0.0	10 Ahau 13 Yaxkin

As Long has noted, the pictun glyph has a coefficient of 1. This, I think, is fair evidence that the coefficient of the pictun which ended at 13.0.0.0.0 4 Ahau 8 Cumku was 0, especially as the Maya priest had just been juggling with pictuns and calabtuns, and therefore desired that there should be no doubt as to the LC position of this date. On the other hand, it is possible that the 1 pictun merely records the distance from 4 Ahau 8 Cumku, although I regard this as a less plausible reconstruction. In any case, the record is positive proof that the Maya thought of the pictun as composed of 20, not 13, baktuns.

On Copan N there is a long calculation into the past (Thompson, 1944a), which again is incorrect as it stands. By changing the katun coefficient from 19 to 7 the distance number will connect the two dates:

(1.13. 0.) 9.16.10.0.0	1 Ahau 3 Zip
14. 17. 7.10.0.0	*Subtract*
(1.12. 5.)12. 9. 0.0.0	1 Ahau 8 Zac

Here the distance is considerably less than in the example for the Temple of the Inscriptions, but reaches 118,950 tuns. Again, the coefficients above that of the baktun are here supplied in accordance with those which may have been in the minds of the astronomers of Tikal.

Tikal 10 has a most unusual inscription of early date. It opens with a day 8 Manik which is followed by three glyphs, any one of which might be the corresponding month position. There follows an IS introductory glyph and then an IS or distance number of eight periods, although the kin and its coefficient are suppressed.

The opposite side of the stela opens with a CR date 4? 13 Uo or Zip, for the downward extension of the reinforced cartouche argues against a month of the Cauac group. This I think may represent 9.2.0.0.0 4 Ahau 13 Uo. In that case the long series of period glyphs probably represents a distance number. Unfortunately, this number will not connect 8 Manik with 4 Ahau, for counted from 8 Manik and calling the kins 13, it leads to 1 Ahau. The variable element in the IS would agree reasonably well with the forms for Uo or Muan (fig. 23,*15*).

I am inclined to think that this sequence should be treated as a distance number because there seems no plausible reason for the base from which the IS would be counted. If a dot is added to the coefficient of the great-great cycle, that is to say, if it is read as 12 instead of 11, the distance number will connect 8 Manik to the date 4 Ahau 13 Uo:

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(0. 0. 0.)19.18. 8.15. 7    8 Manik (10 Mol)
 1.12.19. 9. 3.11. 2.(13)
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(1.13. 0.) 9. 2. 0. 0. 0    4 Ahau 13 Uo
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This reconstruction is not offered with any assurance as to its validity, but as a possible alternative to the reading advocated by Morley. It has one advantage in that the pictun coefficient of the second date can be restored as 0 in accordance with the better interpretation of the 10 Ahau 13 Yaxkin, 1 pictun text at Palenque. It also connects, but with a correction, 8 Manik and the terminal date which is perhaps 4 Ahau 13 Uo. However, it should be noted that there is no evidence that the month position, 10 Mol, is recorded, and there is no apparent notation of 13 kins. Miss Proskouriakoff informs me that she believes on stylistic grounds that this is too early for this stela, but, of course, the count may have been carried forward to a later dedicatory date. The period glyphs of distance numbers are occasionally arranged in descending order, as would be the case were this a distance number. So far as the higher numbers are concerned, there is strong evidence at Quirigua, which will be reviewed, in favor of the suggested reconstruction. The distance number or IS, as it stands uncorrected, amounts to over 5,000,000 years, 5,115,671 tuns to be exact. One's mind reels at such stupendous spans of time.

The Stone of Chiapa has a distance number which, rearranged in descending order, reads 13.13.13.1.?.11.4. The equation can not be restored because the starting point is missing, although 6 Imix 9 Xul is perhaps the preferable reading. The distance is 2,189,220 tuns, well over 2,000,000 years.

A number of calculations, not of such startling magnitude, but of considerable range, occur on Dresden 61, 62. These have been discussed by a number of writers, and the LC position of 9 Kan 12 Kayab, the point of departure, has been established by Beyer (1943b). There are eight of these distance numbers, all of which have the same point of departure, and all of which consist of 4 pictuns, 6 baktuns, and an odd number of katuns, tuns, uinals, and kins. The longest which is correct as it stands can be transposed as follows:

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(1.12.16.) 3.16.14.11.4    9 Kan 12 Kayab
        4. 6.11.10. 7.2        Add
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(1.13. 0.)10. 8. 5. 0.6    3 Cimi 14 Kayab
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The interval is 34,630 tuns; the higher numbers in parenthesis are derived from the suggested reconstruction of the Tikal inscription.

A long distance number on Copan C is preceded by the calabtun glyph with a coefficient of 11, 12, or 13 and the date 6 Ahau 18 Kayab. The equation reads:

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(1.12.19.)17.19.14.17.0    6 Ahau 18 Kayab
          11.14. 5. 1.0
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(1.13. 0.) 9.14. 0. 0.0    6 Ahau 13 Muan
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Conceivably the equation should be moved forward one CR. The association of the calabtun glyph with the earlier date would most logically indictate that the earlier date fell in a calabtun which was not the same as that current during Baktun 9. Should the coefficient of the pictun have been 0 at 13.0.0.0.0 4 Ahau 8 Cumku, as I believe, the coefficient of the calabtun would have been one digit less if a subtraction led back to the previous pictun, because as that pictun had a coefficient of 0, it was necessary to "borrow" from the calabtun, the next highest unit. If, as we have assumed, the coefficient of the calabtun during Cycle 9 was 13 and the pictun coefficient was 0, it follows that the calabtun coefficient corresponding to 6 Ahau 18 Kayab was 12. It is therefore highly probable that the number recorded with these calabtun glyphs on Stela C is 12, the insertion of 12 calabtuns serving as a warning that a calculation far in the past was to follow. This inscription therefore tends to confirm that the pictun coefficient was 0 during the period of the stela cult and is, to a lesser degree, evidence that the calabtun coefficient was 13 at the same time.

I now come to what may be the two greatest feats in calculation attempted by the Maya. On Quirigua F, C16b–C17a, there is a record which appears to read 0 pictuns, 13 kinchiltuns at 1 Ahau 13 Yaxkin (fig. 33,*48*). The kinchiltun glyph appears to be distinguished from the calabtun by a prefix to the left. In fact, 1 Ahau 13 Yaxkin does end 13 kinchiltuns:

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( 0.  1.13.0.)9.16.10.0.0    1 Ahau 3 Zip
  1.  8.13.0. 9.16.10.0.0      Subtract
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(18.)13. 0.0. 0. 0. 0.0.0    1 Ahau 13 Yaxkin
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Here the distance calculated is well over 90,000,000 years, to wit, 91,683,930 tuns. There is, apparently, another count far into the past in this inscription to reach the date 1 Ahau 13 Mol but the calculations elude me.

In a previous paper (Thompson, 1932b) I offered an entirely different decipherment for the date 1 Ahau 13 Yaxkin (Morley, 1937–38, 4:129) in reading the glyph at D16a not as 13 kinchiltuns, but as end of 13 baktuns. This latter reading is not acceptable, however; a hand as an ending sign cannot be placed between the coefficient and the period glyph. The glyph must be 13 kinchiltuns or 13 calabtuns; the prefix to the left suggests that it is the former.

The astronomers of Quirigua appear to have been interested in taking the current date of a monument and casting back until they found some great period far in the past which ended on the same day. Stela D at that city has the dedicatory date 9.16.15.0.0 7 Ahau 18 Pop. At C20 there is recorded 13 kinchiltuns, 7 Ahau 3 Pop (fig. 33,49). The calculation is:

(0. 1.13.0.)9.16.15.0.0	7 Ahau 18 Pop
6. 8.13.0. 9.16.15.0.0	
(13.)13. 0.0. 0. 0. 0.0.0	7 Ahau 3 Pop

This is exactly 5 alautuns or 320,000,000 tuns before the extremely early date on Stela F, and some 400,000,000 years before the date at which Stela D was erected. The calculations to verify these positions are based on the very useful table published by Long (1919).

I feel reasonably confident that the two dates are correctly deciphered, because 1 Ahau 13 kinchiltuns next preceding the date of the IS end precisely on 1 Ahau 13 Yaxkin, and the 13 kinchiltuns which end on 7 Ahau prior to that fall on 7 Ahau 3 Pop. The chances of a date such as 1 Ahau 13 Yaxkin actually being that which marks the end of the first 1 Ahau kinchiltun preceding the IS are 1 in 73; the chances of 3 Pop being the month position of the next preceding 13 kinchiltuns ending on a day 7 Ahau are also 1 in 73.

There are, apparently, other calculations far into the past at Quirigua, notably on Stelae F and A where there are references to dates connected with periods which have coefficients of 19, but I have not been able to elucidate them.

I have throughout assumed that the baktuns were grouped, not in 13's but in 20's, for the evidence supporting a vigesimal count of baktuns in Dresden and at Palenque and Copan is too strong to be overridden. I assume that at an early date, when the LC was first invented, the highest period was the baktun and that baktuns were arranged in re-entering series of 13, but that a subsequent desire to extend the range of time led to the invention of the pictun and still greater periods. With that expansion of time, it was essential to fit the baktuns into a vigesimal count. Consequently, 20 baktuns were made the equivalent of one pictun, but by then 4 Ahau 8 Cumku was so strongly established as the cyclic ending of a round of 13 baktuns that it continued to be given that designation, although reckoned as the end of a cycle of 20 baktuns for the purposes of calculation. Should my reconstruction of the higher periods be correct, 4 Ahau 8 Cumku then became the end of 13 calabtuns, with the theoretical LC position 1.13.0.0.0.0.0.0 4 Ahau 8 Cumku.

In view of what has been written, I think there is reasonably good evidence that the Maya did not have great difficulty in handling numbers involving alautuns, each of which consisted of 64,000,000 tuns. For us, with modern facilities, it is not a simple matter to construct a table of alautun endings; for the Maya it must have been a formidable task. The desire to probe half a billion years into the past reveals a strange mental quirk. It was, perhaps, an attempt to grasp the intangible in order to show that infinity has no starting point. The Maya priest traveled 400 million years backward, but he was as far as ever from the beginning which still eluded him. If time consisted of larger and larger cycles, obviously there was no beginning. I feel reasonably confident that when these stelae came to be erected at Quirigua, the Maya priest-astronomers had accepted the idea that time had no beginning. Withal, there was, I think, in these elucidations of the day and month positions on which these periods ended millions of years ago a certain affinity to the spirit which leads campanologists to seek fresh combinations to extend the changes which can be rung. It is a subject which should also appeal to the psychologist.