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The Mayan Long Count Calendar

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1 Introduction

The Maya had a very elaborate and accurate calendar. First, the Mayan Long Count Calendar (LCC) was used to point historical events from a selected "beginning of time". The Long Count Periods are given on Table 1. It is also characterized by the existence of a religious month Tzolk'in of 260 days and a civic year Haab' of 365 days. One Tzolk'in of 260 days was composed of 13 months (numerated from 1 to 13) of 20 named days. One Haab' of 365 days is composed of 18 named months with 20 days plus one month of 5 days called Uayeb. The number 73 is very important in Mayan civilization and will define all the Long Count Periods as we will see below. The LCC is supposed to begin on 11 August -3113 BC known as the Goodman-Martinez-Thompson (GMT) correlation to the Gregorian calendar based on historical facts and end on 21 December 2012 corresponding to a period of approximately 5125 years. We will explain here the origin of this cycle.

Days	Long Count Period	Long Count period	Approx. solar year
1	1 Kin		-
20	20 Kin	= 1 Winal	0.0547
260	13 Winal	= 1 Tzolk'in	0.7118
360	18 Winal	= 1 Tun	0.9856
7200	20 Tun	= 1 Katun	19.7125
144000	20 Katun	= 1 Baktun	394.2505

Table 1: Table of Long Count Unit.

2 Origin of the Long Count Calendar

When we look at the least common multiple (LCM) of the number of days N of a Long Count Period (LCP) and a Haab' (365 days) we obtain $\text{LCM}(N, 365) = 73 \times N$ as seen on Table 2. That means that every Long Count Period P coincides with the Haab' cycle every $73 P$.

LCP	N [day]	$\text{LCM}(N,365)$	$\text{LCM}(N,365)/N$
Tzolk'in	260	18980	73
Katun	7200	525600	73
Baktun	144000	10512000	73
Pictun	2880000	210240000	73
Calabtun	57600000	4204800000	73
Kinchiltun	1152000000	84096000000	73
Alautun	23040000000	1681920000000	73

Table 2: Coincidence of the civic month Haab' with the Long Count Period (LCP).

When we look at the least common multiple of the number of days N of a Long Count Period (LCP) and a Tzolk'in (260 days) we obtain $\text{LCM}(N,260) = 13 \times N$ as seen on Table 3. There is for example a Katun cycle of 93600 days and a Baktun cycle of 1872000 days corresponding respectively to 360 and 7200 Tzolk'in. This means that the Baktun cycle coincides with the Tzolk'in cycle every 13 Baktun corresponding approximately to 5125 years.

LCP	N [day]	$\text{LCM}(N,260)$	$\text{LCM}(N,260)/N$
Tun	360	4680	13
Katun	7200	93600	13
Baktun	144000	1872000	13
Pictun	2880000	37440000	13
Calabtun	57600000	4204800000	13
Kinchiltun	1152000000	14976000000	13
Alautun	23040000000	299520000000	13

Table 3: Coincidence of the religious month Tzolk'in with the Long Count Period (LCP).

The two calendar, the Tzolk'in and the Haab', coexist along with the Long Count Calendar. The Tzolk'in and the Haab' coincides every 73 Tzolk'in or 52 Haab': $73 \times 260 = 52 \times 365 = 18980$ days. The Tzolk'in shows the importance of the number 73 which rythmed the religious event of the Maya.

3 Datation in the Long Count Calendar

According to the GMT correlation, the Date Zero of the LCC, noted 0.0.0.0.0, corresponds to 11 August -3113 BC (the 223rd day of the year). Knowing N the number of day after the Date Zero, we calculate the year Y and day D as follow:

$$Y = \text{Int}(N/Y_s) - 3113, \quad (1)$$

and

$$D = (N/Y_s - Y) \times Y_s + 223, \quad (2)$$

where $\text{Int}(X)$ is the integer part of X , $Y_s = 365$ days, 5 hours 49 minutes 19 seconds the computed solar year (the time period between to consecutive winter solstices, taken as the exact number of day of a year), we obtain the end of the 13 Baktun cycle on the 355th day of the leap year 2012 or the date 20 December 2012. The 356th day of 2012 is the date 21 December 2012, the winter solstice, noted 13.0.0.0.1 in the LCC, which is the beginning of a new 13 Baktun cycle. This validates the GMT correlation to the Gregorian calendar. The 20 December 2012 corresponds to 13.0.0.0.0 and the 19 December 2012 is the date 12.19.19.17.19.

4 Conclusion

We have demonstrated the origin of the Mayan Long Count Calendar. We have validated the Goodman-Martinez-Thompson correlation to the Gregorian calendar. It seems that the Mayan knew an algorithm to calculate such great numbers. This shed more light on Mayan mathematical skills. Further studies need to be done to find the properties of those numbers.

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