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Math is everywhere. Here's a tale where a bit of number theory let a couple of archeologists, Marion and Matthew Stirling, figure out that the Olmec civilization was incredibly old.

The Stirlings found the stone here in Mexico, and guessed that the date written on it was 7.16.6.16.18. In the calendar used by the Olmecs and other Central American civilizations, this corresponds to September 3, 32 BC.

But the first digit was missing from this part of the stone! All the Stirlings actually saw was 16.6.16.18. And the first digit was the most significant one! If it were 8 instead of 7, the date of the stone would be much later: roughly 362 AD, when the Mayans were in full swing.

The Stirlings guessed that the first digit must be 7 using a clever indirect argument.

The Olmecs and Mayans used two calendars! In addition to the calendar I just mentioned, called the Mesoamerican Long Count, they also used one called the Tzolk'in. This uses a 260-day cycle, where each day gets its own number and name: there are 13 numbers and 20 names. And inscribed on this stone are not only the last four digits of the Mesoamerican Long Count digits, but also the Tzolk'in day: 6 Etz'nab.

This is what made the reconstruction possible!

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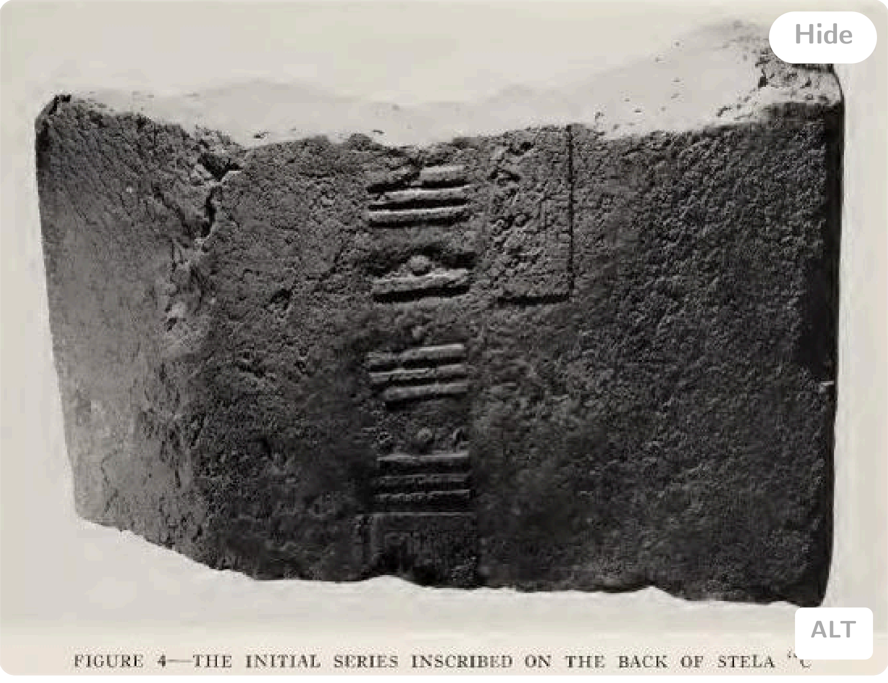

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The Meso-American Long Count identified any day by counting how many days passed since the world was created. This count is more or less in base 20, except that the second "digit" is in base 18, since they liked a year that was 18 × 20 = 360 years long. So,

7.16.6.16.18

would mean

$7 \times 144{,}000 + 16 \times 7{,}200 + 6 \times 360 + 16 \times 20 + 18 = 1{,}125{,}698$ days

after the world was created. But if the first digit was 8 instead of 7, the date would be 144,000 days later.

The Olmec's other calendar, the Tzolk'in, uses a 260-day cycle. Here each day gets its own number and name: there are 13 numbers and 20 names. And the rock the Stirlings found had inscribed not only the last four digits of the Mesoamerican Long Count, but also the Tzolk'in day: 6 Etz'nab.

Here's why 7 was the only possible choice of the missing digit. Because the last four Long Count digits (16.6.16.18) are fixed, the total day count must be

$B \times 144{,}000 + 117{,}698$.

for some B. But

$144{,}000 = 0 \bmod 20$,

and there are 20 different Tzolk'in day names, so changing B by one doesn't change Tzolk'in day name.

On the other hand, there are 13 different Tzolk'in day numbers, so adding one to B adds

$144{,}000 \equiv -1 \pmod{13}$

days to the Tzolk'in day number. This means that after the day

7.16.6.16.18 and 6 Etz'nab

the next day of the form

N.16.6.16.18 and 6 Etz'nab

happens when $N = 7+13$. But this is $13 \times 144{,}000$ days later: that is, roughly 5,094 years after 32 BC! Far in the future!

So, while 32 BC seemed awfully early for the Olmecs to carve this stone, there's no way they could have done it later. (Or earlier, for that matter.)

For a fuller story, read my blog article!

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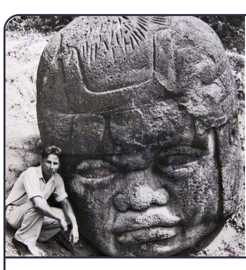

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> a year that was 18 × 20 = 360 years long

"years" should be "days"

0

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Thank you for sharing this😀

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