

## ANTHROPOLOGY

# An early Maya calendar record from San Bartolo, Guatemala

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Here, we present evidence for the earliest known calendar notation from the Maya region, found among fragments of painted murals excavated at San Bartolo, Guatemala. On the basis of their sealed contexts in an early architectural phase of the “Las Pinturas” pyramid, we assign these fragments to between 300 and 200 BCE, preceding the other well-known mural chamber of San Bartolo by approximately 150 years. The date record “7 Deer” represents a day in the 260-day divinatory calendar used throughout Mesoamerica and among indigenous Maya communities today. It is presented along with 10 other text fragments that reveal an established writing tradition, multiple scribal hands, and murals combining texts with images from an early ritual complex. The 7 Deer day record represents the earliest securely dated example of the Maya calendar and is important to understanding the development of the 260-day count and associated aspects of Mesoamerican religion and cosmological science.

## INTRODUCTION

Archaeological excavations at the Maya site of San Bartolo, Guatemala, have revealed a number of important wall paintings dating to the Late Preclassic period (400 BCE to 200 CE) (1, 2). These came from a single architectural complex called Las Pinturas, comprising a pyramid with seven construction phases and several auxiliary structures. The well-known polychrome murals of San Bartolo depict deities and humans in scenes of an origin mythology akin to a charter of lowland Maya society and religion, which were painted within a temple, Structure Sub-1A, from the penultimate phase of the Pinturas complex, dating to ~100 BCE. Investigations of the architectural foundation of this ritual complex revealed even earlier paintings, a fragment from which bore important evidence of early Maya hieroglyphic script, dating to approximately 300 to 200 BCE, and this remains one of the earliest examples of Mesoamerican writing from a well-dated context (3). Here, we report on other wall fragments revealed from subsequent excavations of the same area, all bearing hieroglyphic writing. One important piece bears a hieroglyphic date in the 260-day ritual calendar, offering the earliest evidence of this calendar in the Maya region. As part of reporting on these specific finds and their significance, we provide two additional radiocarbon (<sup>14</sup>C) assays, which are paired with recalibrated dates from previous samples to refine dating of these early contexts and their associated paintings and texts from San Bartolo.

## Phases of the Pinturas complex

The Las Pinturas pyramid complex is located at the geographic center of the small Late Preclassic site of San Bartolo. In its final construction phase, a large pyramid (Structure 1) dominated the east side of a raised platform shared with two smaller buildings on the north and south in a triadic arrangement facing west; a fourth structure closed the temple patio on the west side located at the top of the stairway accessing the complex. The final phase of Structure 1 dates to the first century CE, with monumental construction ceasing throughout San Bartolo by 150 to 250 CE (3). Archaeological excavations

in the Pinturas complex revealed a total of seven major construction phases that span 400 BCE to 100 CE; many of these phases, like its final construction, were composed of multiple buildings defining a ritual complex. In general, each new construction completely covered the earlier construction within its foundation.

The third earliest phase of Las Pinturas, labeled Sub-V, was a complex defined by three structures: a radial pyramid, a ballcourt, and a long platform, which together formed an “E-group” architectural arrangement associated with Maya astronomical observations and calendrical science (Fig. 1) (4). The Sub-V ritual complex incorporated symbolic content in the form of modeled lime plaster masks on the facades of the radial pyramid, a painted marker at the center of the ballcourt, and painted murals on architectural surfaces (5). San Bartolo provides excellent chronological evidence for use of artistic media in regional Late Preclassic traditions: notably, no carved stone monuments were associated with this complex and do not appear until the final architectural phase of Las Pinturas with the erection of Stela 5 (6). During the Late Preclassic period, paint on lime plaster surfaces was the dominant art form for iconography and writing in lowland Maya architecture and landscapes.

The Sub-V complex was terminated in a single construction event that subsumed the radial pyramid, ballcourt, and long eastern platform within the foundation of a large pyramid (Sub-IV) (Fig. 2). While its basal constructions were buried intact, wall scars indicate that the architecture at the summit of both the pyramid and the eastern platform were razed. During excavations through the fill that covered the Sub-V complex, we encountered numerous broken fragments of lime plaster in the area of the eastern platform, referred to as structure “Ixbalamque.” In total, 249 fragments of lime plaster with evidence for painted or incised design were collected from Sub-V contexts during archaeological investigations spanning 2005 to 2010 (Fig. 1 and data S1 and S2). Many of these fragments were found mixed in with the bulk of rock, mud, and soil fill material covering the Ixbalamque structure; however, a subset of fragments ( $n = 94$ ) with figural and textual elements were recovered archaeologically from secondary contexts directly upon the platform surfaces of structure Ixbalamque.

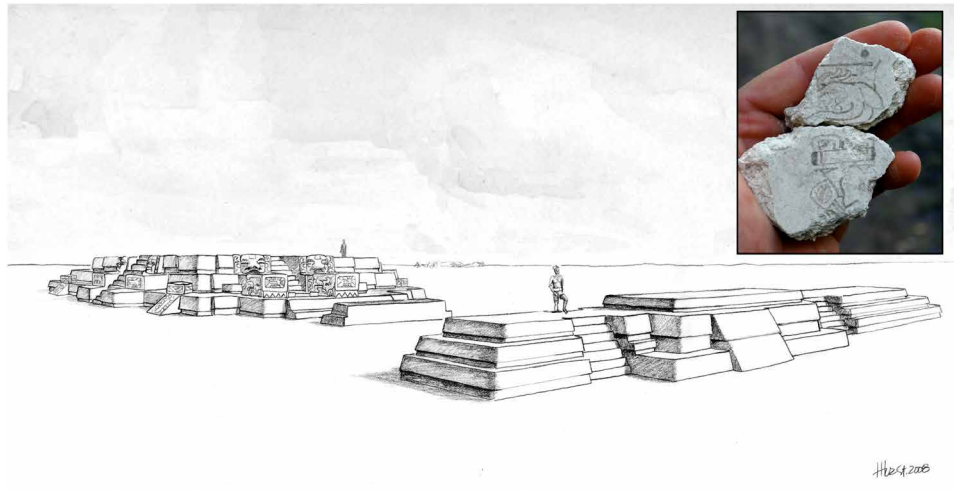
On the basis of the architectural evidence and depositional context of mural fragments, it is likely that wall paintings were originally part of the superstructure of Ixbalamque or part of an unknown

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**Fig. 1. Reconstruction of San Bartolo Sub-V phase architectural complex and the 7 Deer day-sign mural fragments associated with this context.** Reconstruction view of the San Bartolo Sub-V phase architecture (300 to 200 BCE) showing radial structure, miniature ballcourt, and elongated platform referred to as structure Ixbalamque that together form an E-group. Drawing by Heather Hurst. Inset: Example of two mural fragments (consolidated as #4778), the 7 Deer day-sign and partial hieroglyphic text, among a total of 249 fragments of painted plaster and painted masonry blocks collected during archaeological excavations of the Ixbalamque context. Photograph by Karl Taube, courtesy of the Proyecto Regional Arqueológico San Bartolo-Xultun.

building that was contemporary with this platform. During the third century BCE, the ancient Maya broke wall paintings and razed the superstructure architecture of the Sub-V buildings (3). As part of this termination event, numerous painted plaster fragments were deposited on the tiers of the long platform of the E-group (structure Ixbalamque), while others ended up mixed into the tons of construction fill that covered the ritual complex; lastly, the base of a newly constructed large pyramid (Structure Sub-IV) engulfed the earlier Sub-V platforms, the broken mural fragments, and their dismantled superstructures (7–9).

### The Sub-V fragment corpus

The mural fragments associated with Las Pinturas Sub-V phase indicate that some architectural surfaces were densely painted, while other areas had delicate line text and line paintings with large margins of white (unpainted) plaster. Although these are some of the earliest figural mural paintings yet found in the Maya lowlands, they are masterful artworks depicting imagery associated with religious beliefs, such as the maize god, combined with texts. The characteristics of the mural fragments provide evidence for the extent of architectural decoration and the technological development of the wall painting practice associated with the Sub-V phase. The fragments vary in their physical and stylistic attributes, falling within two groups: (i) masonry blocks coated with a thin substrate layer of coarse lime plaster (5 to 10 mm) and a finish coat fine lime plaster with polychrome paint (10 to 15 mm) (Figs. 3 and 4) and (ii) lime plaster fragments consisting of a thicker substrate layer of coarse lime plaster (10 to 20 mm) and finish coat fine lime plaster (10 to 15 mm) with monochrome or polychrome paint (Fig. 5). The masonry blocks have finish plaster on adjacent sides, suggesting that they come from architectural features, like a door jamb or a corner. The second group of fragments likely came from vertical surfaces with less finely shaped masonry support, requiring a thicker application of substrate plaster for leveling. On the basis of comparison with the later Las Pinturas architectural paintings, the high quality of fine

plaster and the preservation condition associated with the Sub-V fragments are most similar to interior mural fragments rather than fragments collected from exterior paintings.

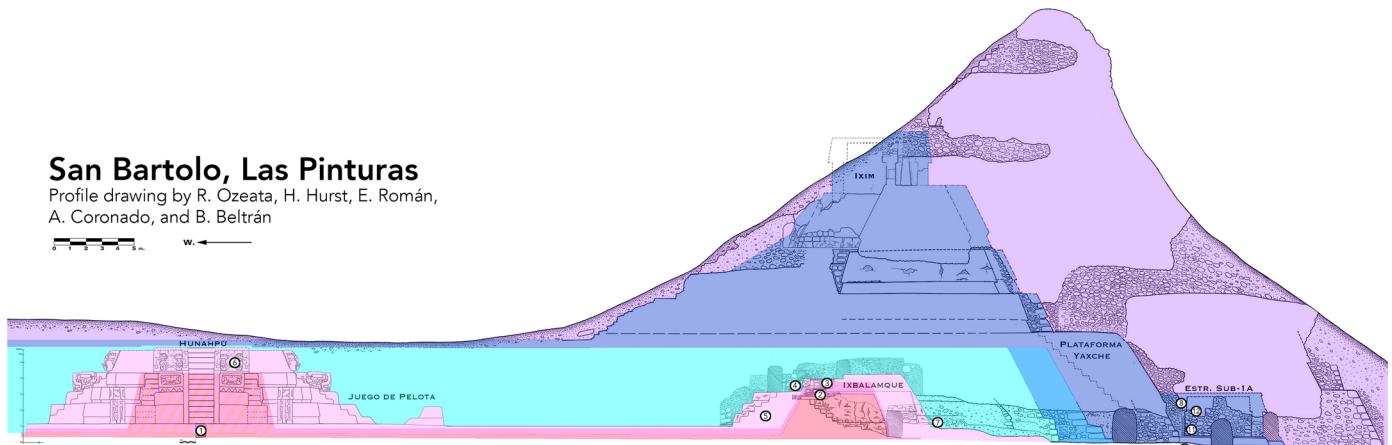
The mural plaster and paint technology of Las Pinturas Sub-V (~300 to 200 BCE) can be characterized as well processed, well bound, and technologically similar to Maya mural painting from 100 BCE (10, 11) and comparable to murals from the eighth century CE (12) in terms of durability and purity. The composition of fine plaster from Sub-V fragments is well processed with heterogeneous sub-rounded and rounded particles of aggregate that are well bound within the calcium carbonate; the surface is polished with a lustrous uniform finish. The Sub-V mural paintings include highly processed iron mineral pigments in hues of red, dark red, light red, pink, and yellow, as well as evidence for both carbon-based and iron-based black. Among the black paints, x-ray fluorescence spectra identify that an iron-based black pigment was used for calligraphic line, but hieroglyphic texts are similar in composition to background samples suggesting that these may be painted with a carbon-based black (10). Although this may be due to the small quantity of pigment present in the line of a Sub-V glyph, it is notable that both iron-based and carbon-based black pigments were identified in the Sub-1A murals, and distinct pigment preparation methods were selected on the basis of iconography and associated symbolism of the painted image (11). These characteristics among the Sub-V fragments are evidence of advanced lime plaster and pigment technology specialized for wall painting. The stylistic techniques of blending color, use of multiple black paints, and iconographic complexity are consistent with a well-established tradition of master artists.

### RESULTS

In 2005, our excavation project reported the discovery of a single masonry block (fragment #6366) from the Sub-V phase, Ixbalamque structure of the Pinturas complex bearing plaster and a painted vertical line of hieroglyphs (3). This remains one of the earliest pieces

### San Bartolo, Las Pinturas

Profile drawing by R. Ozeata, H. Hurst, E. Román, A. Coronado, and B. Beltrán



Architectural phases:

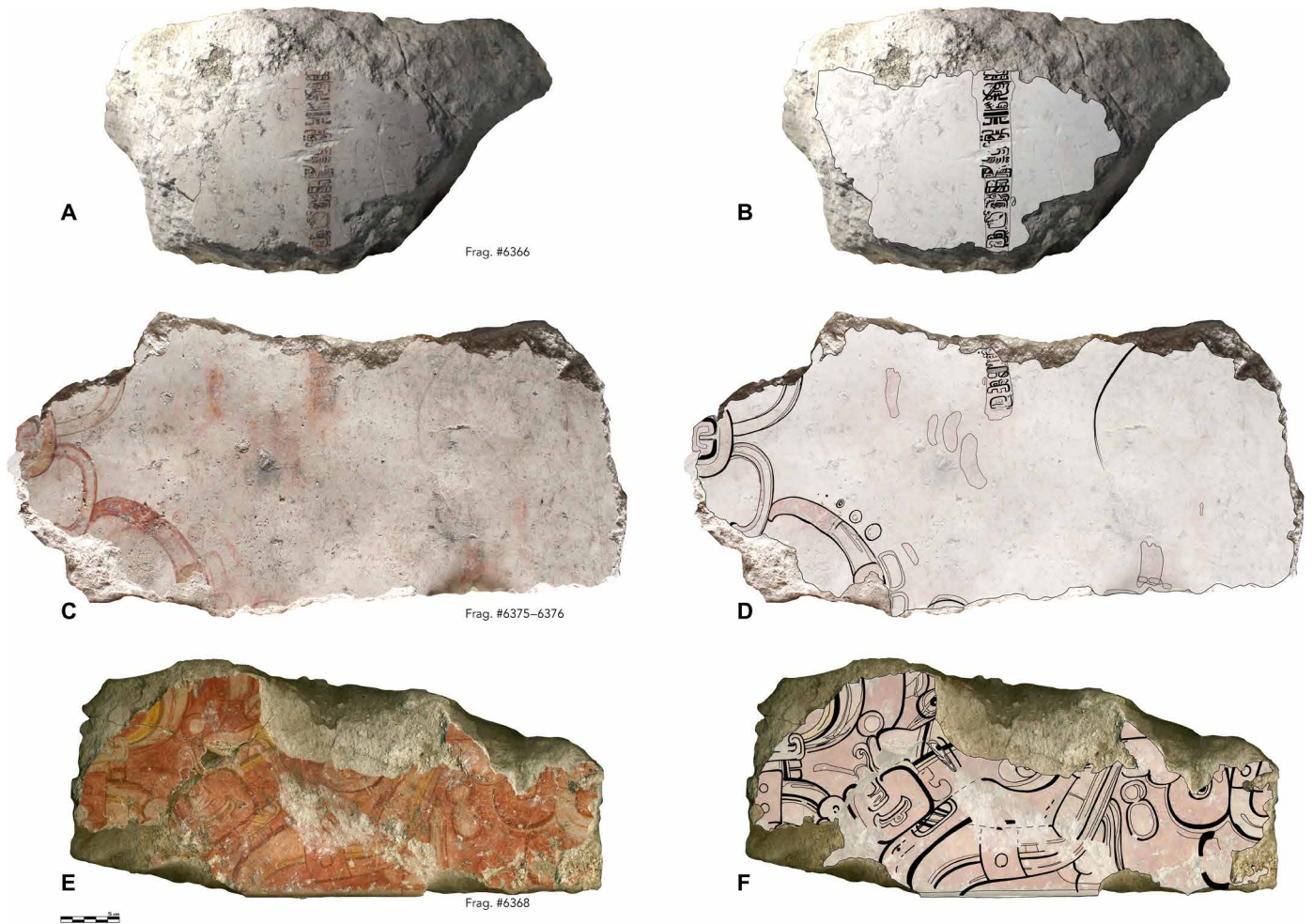
Locat. #	Terminus post quem Sub-V mural	Sample#	Context #	<sup>14</sup> C age B.P.	<sup>δ14</sup> C age - 95% range	Calibration program	Description of sample context
1	Las Pinturas, Sub-V construction	AA-114622	SB-1A-34-83-2	2246 ± 47	395 to 195 BCE	IntCal20, OxCal v4.4.4	Collected from undisturbed deposit below floor of Sub-V phase radial pyramid "Hunahpu" and above bedrock.
2	Las Pinturas, Sub-VI construction	Beta-206576	SB-1A-32-3	2260 ± 40	400 to 200 BCE	IntCal20, OxCal v4.4.4	Collected from undisturbed deposit between floors of phase Sub-VI and Sub-VII platforms "Ixmuucane" and "Ixquik."
3	Las Pinturas, Sub-V construction	Beta-206577	SB-1A-32-7	2200 ± 60	390 to 60 BCE	IntCal20, OxCal v4.4.4	Collected from an undisturbed deposit within the floor of the Sub-V platform "Ixbalamque."
Locat. #	Occupation/termination of Sub-V mural	Sample#	Context #	<sup>14</sup> C age B.P.	<sup>δ14</sup> C age - 95% range	Calibration program	Description of sample context
4	Las Pinturas, Sub-V use/termination	Beta-206624	SB-1A-34-10	2260 ± 40	400 to 200 BCE	IntCal20, OxCal v4.4.4	Collected from an undisturbed deposit amidst the fallen wall stones of the Sub-V "Ixbalamque" superstructure in direct association with the fallen hieroglyphic and other plain and painted blocks; likely that it originated with the construction materials and was redeposited with the destruction of its walls.
5	Las Pinturas, Sub-V use/termination	Beta-206578	SB-1A-34-5	2180 ± 40	370 to 105 BCE	IntCal20, OxCal v4.4.4	Collected from an undisturbed deposit on the surface of the stairs of Sub-V "Ixbalamque" platform in direct association with mural fragments; likely that it originated with the construction materials and was redeposited with the destruction of its walls.
Locat. #	Terminus ante quem Sub-V mural	Sample#	Context #	<sup>14</sup> C age B.P.	<sup>δ14</sup> C age - 95% range	Calibration program	Description of sample context
6	Las Pinturas, Sub-IV construction	AA-114621	SB-1A-34-78-1	2150 ± 47	360 to 55 BCE	IntCal20, OxCal v4.4.4	Collected from fill covering the south façade mask of Sub-V "Hunahpu"; dates the termination of Sub-V architecture and the construction of Sub-IV phase architecture.
7	Las Pinturas, Sub-IV construction	Beta-206575	SB-1A-24-7	2150 ± 40	355 to 50 BCE	IntCal20, OxCal v4.4.4	Collected from a secondary trash deposit within the fill of the Sub-IV construction phase; dates the termination of Sub-V and the construction of Sub-IV.
Locat. #	Terminus post quem Sub-1A mural	Sample#	Context #	<sup>14</sup> C age B.P.	<sup>δ14</sup> C age - 95% range	Calibration program	Description of sample context
8	Las Pinturas, Str. Sub-1A construction	Beta-193509	SB-1A-11-6	2140 ± 40	355 to 45 BCE	IntCal20, OxCal v4.4.4	Removed from within the plaster matrix of the in situ Str. Sub-1A mural; dates the construction of the Sub-1A chamber.
9	Las Pinturas, Sub-I construction	Beta-193512	SB-1A-17-6	2100 ± 40	345 BCE to 10 CE	IntCal20, OxCal v4.4.4	Collected from undisturbed deposit below floor of Sub-I phase construction; test pit located immediately outside southern door of Structure Sub-1A.
10	Las Pinturas, Sub-I construction	Beta-193513	SB-1A-17-6-1	2050 ± 40	170 BCE to 60 CE	IntCal20, OxCal v4.4.4	Collected from undisturbed deposit below floor of Sub-I phase construction; test pit located immediately outside southern door of Structure Sub-1A.
Locat. #	Occupation/termination of Sub-1A mural	Sample#	Context #	<sup>14</sup> C age B.P.	<sup>δ14</sup> C age - 95% range	Calibration program	Description of sample context
11	Las Pinturas, Str. Sub-1A use/termination	Beta-193510	SB-1A-21-1-8	2070 ± 40	195 BCE to 25 CE	IntCal20, OxCal v4.4.4	Collected from a deposit of charred material upon the floor at the base of the west wall of Sub-1A mural chamber.
Locat. #	Terminus ante quem Sub-1A mural	Sample#	Context #	<sup>14</sup> C age B.P.	<sup>δ14</sup> C age - 95% range	Calibration program	Description of sample context
12	Las Pinturas, Final phase construction	Beta-193511	SB-1A-11-6-1	2050 ± 50	195 BCE to 110 CE	IntCal20, OxCal v4.4.4	Collected from the Final phase construction material within the Structure Sub-1A mural chamber.

Note: All samples are measured on wood charcoal; all dates are calibrated. Earlier phase (Sub-VI and/or Sub-VII) of Hunahpu radial structure unconfirmed.

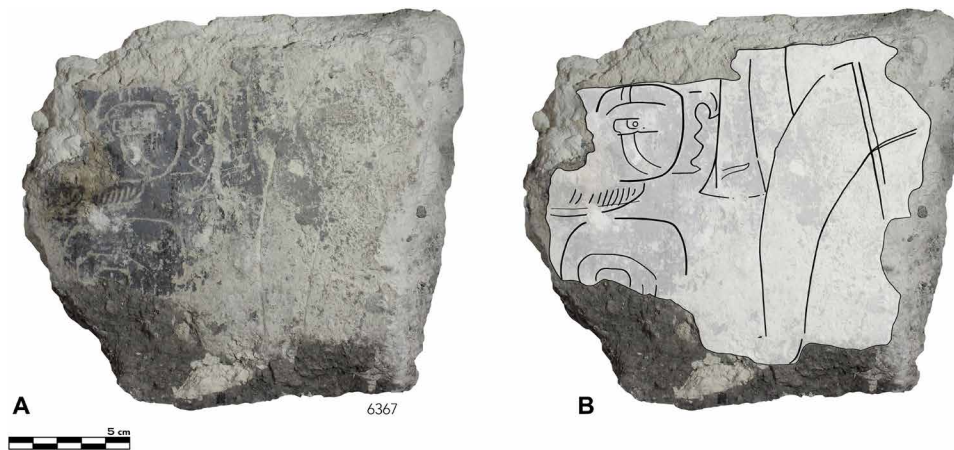
**Fig. 2. Profile of Las Pinturas (Structure 1), architectural phases, and chart summarizing 12 <sup>14</sup>C dates from samples collected from the Final, Sub-I, Sub-IV, Sub-V, and Sub-VI phases of construction.** The 12 sample results are grouped by activity context to provide terminus post quem, occupation/termination, and terminus ante quem dates for the two programs of mural painting and hieroglyphic texts that are associated with Sub-V and Sub-I construction phases. Image courtesy of the Proyecto Regional Arqueológico San Bartolo-Xultun.

of evidence for the early use of hieroglyphic writing in the Maya region. Other text fragments from the same excavation context, some found later, are here reported. Among the corpus of the San Bartolo Las Pinturas Sub-V mural fragments (*n* = 249), a small subset

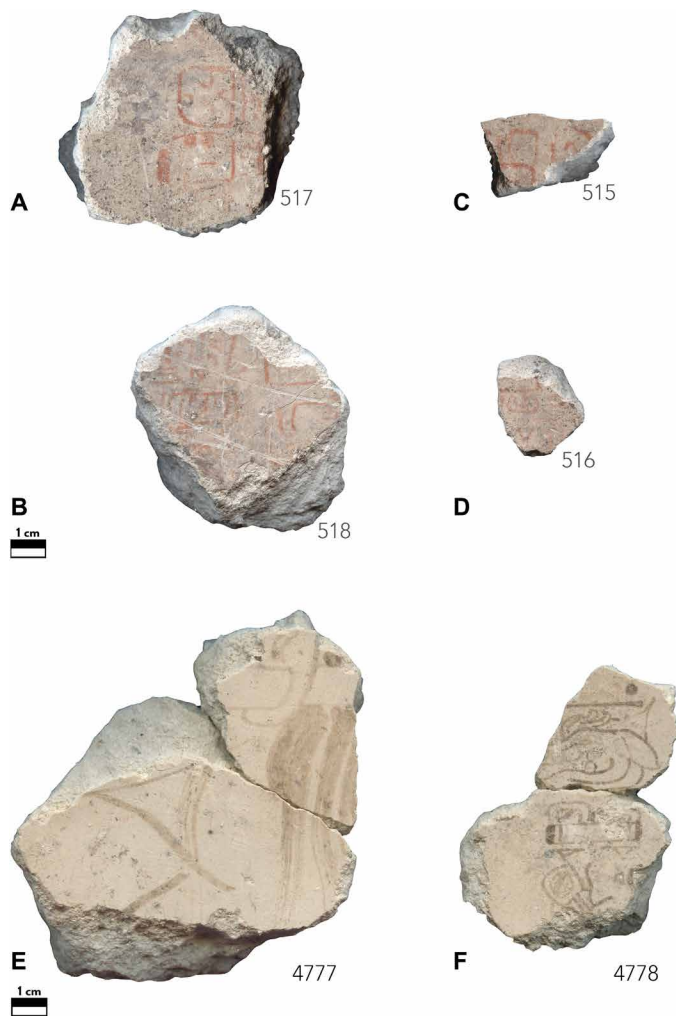
(*n* = 11) of fragments are painted or incised with glyphic images (Figs. 3 to 5 and data S2). These include three styles: black-line texts, red-line texts, and incised texts. The fragments with glyphs were collected from two areas during archaeological excavations: one group,



**Fig. 3. Wall painting fragments on masonry blocks associated with the Ixbalamque range structure.** Three mural fragment blocks collected from the Ixbalamque structure, Sub-V architectural phase (300 to 200 BCE) with digital images (left) and illustrations (right) of fragments: (A and B) #6366 with hieroglyphic text and red pigment; (C and D) #6375 to 6376 with four (partial) glyphs of a hieroglyphic text and polychrome figural painting; and (E and F) #6368 with the image of the Late Preclassic period Maya maize god. Imaging by Heather Hurst and William Saturno and drawings by Heather Hurst and David Stuart.



**Fig. 4. Incised lime plaster on masonry blocks associated with the Ixbalamque range structure with hieroglyphs and figural image.** Fragment #6367, a masonry block coated with finish lime plaster, incised with two partial hieroglyphs and figural imagery of possibly an arm, torso, and cloth element that was collected from the Ixbalamque structure context (300 to 200 BCE). (A) Photograph by Heather Hurst and (B) illustration by Heather Hurst and David Stuart.



**Fig. 5. Wall painting fragments on lime plaster substrate collected from the Sub-V phase termination deposit (~300 to 200 BCE), showing red-line and black-line painting styles.** Mural fragments in red-line painting style from the Sub-V phase architectural complex depict two columns of glyphs in similar scale and layout including #515 to 518, #4777, and 4778; paired with drawings (A) #517 and (B) #518 that may have been related one above the other, and fragments (C) #516 and (D) #516 that have partial hieroglyphic signs suggesting two columns of glyphs as well. Black-line style mural fragments from the Sub-V phase, collected from the Ixbalamque structure include (E) #4777 with figural imagery, possibly hair and text elements, and (F) the scan of consolidated fragment #4778 depicting the 7 Deer day sign and two hieroglyphic signs in a vertical column. Scans by Heather Hurst.

which included six fragments with black-line and incised texts, were from secondary depositional contexts atop tiers of the platform known as Ixbalamque of the E-group; and a second group of four red-line fragments were collected 4.5 m north of the Ixbalamque structure near plaza level (7–9).

### Dating the fragment corpus

Although collected in separate locations, all mural fragments were deposited in fill that represents a single construction event that covered the Sub-V complex and created the foundation for Sub-IV phase architecture. This sealed deposit provides a potential terminus ante quem date for the mural fragments, while carbon samples

from within the Sub-V, Sub-VI, and Sub-VII construction materials could provide a terminus post quem date. Twelve radiocarbon dates measured on carbonized wood associated with the Las Pinturas architectural sequence present a chronology spanning the Late Pre-classic period (400 BCE to 200 CE) (Fig. 2 and data S3). The samples reported here include two additional assays and updates to the sequence from earlier reports (3); these newly analyzed samples from the radial temple are consistent with recalibrated previous samples. In dating the Sub-V text fragments, there is substantial overlap in the dates from seven samples associated with terminus post quem and terminus ante quem contexts, with Sub-V construction and use dating to 400 to 100 cal BCE (95% probability), and Sub-IV fill material dating to 360 to 50 cal BCE (95% probability). The Sub-I construction phase with its extensive mural programs is approximately 100 to 200 years later, with five samples from sealed construction and termination contexts dating to 200 cal BCE to 80 cal CE (95% probability). A Bayesian analysis of these radiocarbon dates further refines the probability for the construction and destruction of Sub-V architecture and its associated text and mural fragments by incorporating stratigraphic relationships in the model, as well as considering the common practice of using older wood, which might skew dates earlier (Table 1 and data S3). It is probable that the Sub-VII and Sub-VI phases of the E-group were built in the fourth or third centuries BCE, with its long eastern structure rebuilt shortly after initial construction, and, when together with the dates from the Sub-1A phase, that all of the Sub-V texts were likely painted and incised between 300 and 200 BCE, with greatest probability being the latter half of the third century BCE.

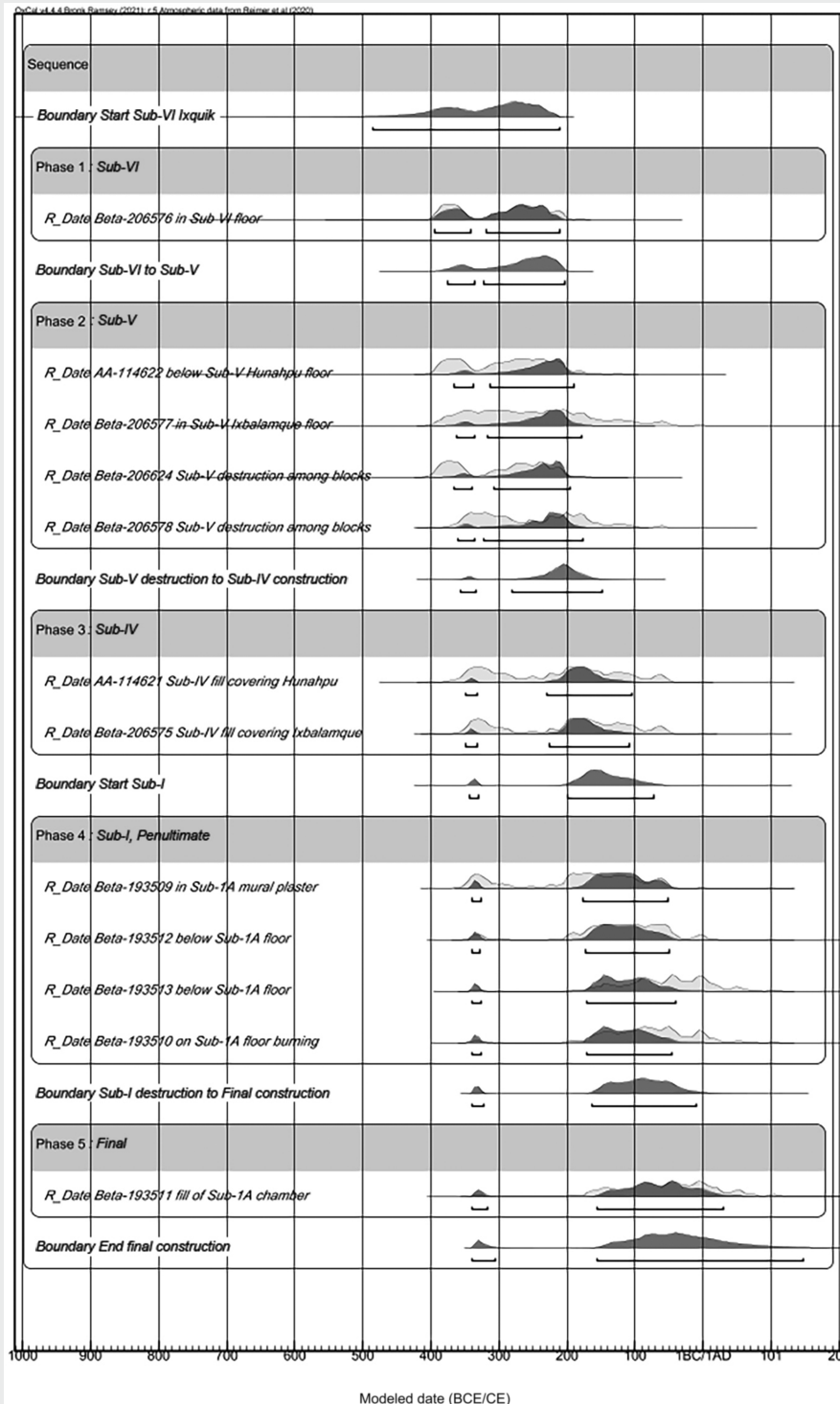
### The text fragments

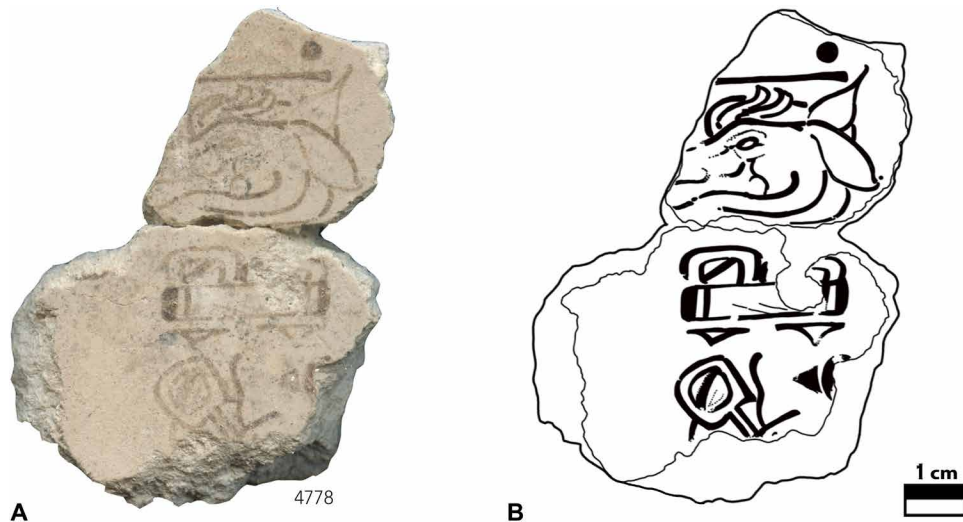
The Sub-V text fragments contain a second large masonry block (fragment #6375) bearing four hieroglyphs, identical in style to the 10 hieroglyphs painted on the block previously reported (fragment #6366) (Fig. 3). The block is painted in black, red, and yellow on a white (unpainted) background. To the lower left of the hieroglyphs, two curved elements indicate that the text was located near figural imagery; although incomplete, these elements are similar to cloth elements represented in the Sub-1A murals. The Sub-V block #6375 may be from the very same text of fragment #6366, the first positioned below the other in the original wall. The size of the signs is similar and the red hematite “streak” that serves to highlight the text is visually identical and chemically similar on both blocks.

A third masonry block (#6367) bears a coat of plaster with two lightly incised hieroglyphs, vertically arranged beside the possible elements of a figure (Fig. 4). These are the only incised glyphs known from San Bartolo, and it is difficult to know whether they represent wall graffiti or some more formal presentation of writing. The two hieroglyphs include a human-looking profile with a beard above an incomplete circular element. Neither sign is clear in terms of identification or reading. To the right of the glyphs, two curving lines taper downward adjacent to a rectangular form. This is suggestive of a human torso and arm. A smaller flared element to the immediate right of the top glyph appears similar to cloth of a head-dress or hair in its rendering, scale, and position compared to other San Bartolo paintings. Although the interpretation is tentative, the incised program of artwork associated with Sub-V phase architecture also combined figures and text.

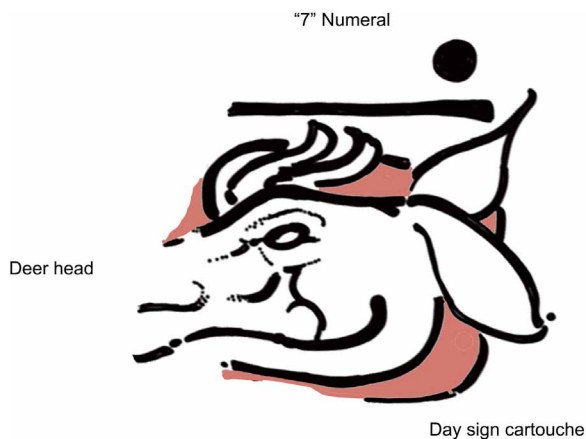
To the north of the Ixbalamque platform, four small lime plaster fragments (#515 to 518) were found at plaza level and bear light red

**Table 1. Modeled radiocarbon dates.** Bayesian model for the radiocarbon dates associated with San Bartolo Las Pinturas incorporating information on stratigraphic relationships. Bars under probability distributions indicate 95.4% probability ranges; there were no outliers in the model. All dates are measured on carbonized wood.





**Fig. 6. Detail of fragment #4778 collected from the Sub-V phase (~300 to 200 BCE), with the 7 Deer day sign.** Consolidated mural fragment #4778 in black-line style, collected from the Ixbalamque structure: (A) the digital scan and (B) the illustration depicting the 7 Deer day sign and two hieroglyphic signs in a vertical column. Scans by Heather Hurst and illustration by David Stuart.



**Fig. 7. Detail of the 7 Deer day sign, San Bartolo, Guatemala.** Illustration of the 7 Deer day sign from San Bartolo mural fragment #4778 with annotation of year, cartouche (color added for visibility), and deer head. Drawings by David Stuart.

linework that suggests that they represent two columns of painted hieroglyphs (Fig. 5, A to D). These four fragments share the same depositional context and surely are from a single area of painting or wall decoration. Internal details of these painted forms are very difficult to discern, but the cartouches of several hieroglyphs are visible enough to conclude that they hieroglyphs. One sign bears a vague resemblance to the logogram WINIK, “person,” or the related term WINAL, “20-day period.” It is impossible to analyze these forms as a text, but we are confident in identifying the forms as very early examples of the Maya script.

The final group of text fragments is composed of four small fragments with black line painting on a white (unpainted) background; these were conserved into two groups (#4777 and #4778) and are closely associated with one another (Fig. 5, E and F). These fragments are similar to the masonry blocks in terms of technology and painting style; however, their direct relationship to the other

fragments recovered from the Sub-V excavations is unknown. Two of the joined fragments (#4777) may depict parts of a human figure, possibly showing hair and a cloth band (Fig. 5E). The other joined fragments (#4778) have clear hieroglyphic signs in a vertical arrangement, the first being a calendrical date in the 260-day ritual calendar used throughout Mesoamerica (Fig. 6). A second smaller glyph shows an unidentified main element and the suffix -la. It remains unclear whether the linework at the base of this groups shows a third hieroglyph or is perhaps a portion of the imagery or iconography that was once associated with it as a caption.

Decipherment of this archaic form of Maya script remains a challenge (1, 3). A few individual signs appear antecedent to well-known elements of the later Classic script, as we will show, whereas others seem unique or difficult to analyze.

### The 7 Deer date of mural fragment #4778

The first glyph, larger than the other(s) that follow, shows the bar-and-dot number 7 above an animal head that clearly represents a deer (the left dot of the number is missing) (Figs. 6 and 7). Surrounding the head is a simple cartouche, backgrounded in relation to the deer, whose ears expand out from the spatial confines of the glyph. Its form indicates that it is a date record in the Mesoamerican 260-day calendar, “7 Deer,” or, in the colonial Maya system of 16th century Yucatán, “7 Manik’.” Here, it appears to be in an initial position, perhaps as part of a caption for an accompanying scene or a human figure, now lost.

The 260-day count is the traditional divination calendar used throughout ancient Mesoamerica, surviving up to the present among some indigenous communities in southern Mexico and Guatemala. Designations for individual days involve two elements: a number from 1 to 13 combined with 1 of 20 named days in a set order. In the system used by the Mexica (Aztecs) of the 16th century, the day 7 Deer (7 Mazatl) would be followed by 8 Rabbit, 9 Water, 10 Dog, 11 Monkey, 12 Grass, and so on. The meanings were often similar across languages, forging a calendar system that came to be an elemental factor in the definition of “Mesoamerica” as a cultural region.



**Fig. 8. Comparison of day signs for Deer in Mesoamerican writing.** (A) Isthmian script, La Mojarra, Stela 1; (B) Maya script, La Corona, Element 4; (C) Maya script, Yaxchilan-area lintel; (D and E) Central Mexican script (simple and full-figure forms) Codex Borgia; (F) Maya script, Uaxactun Str. B-XIII murals; (G) Maya script, Ek Balam murals. Drawings by David and George Stuart.

For example, the word for the seventh day in Nahuatl is *Mazatl* (“Deer”) which corresponds to Zapotec *China* (Deer), and Mixtec *Cuaa* (Deer). In many Mayan languages, especially in the Guatemalan highlands, the name for the seventh day also was Deer, as in K’iche’ *Keej*. The diverse writing systems of ancient Mesoamerica reflect this widespread meaning, nearly all showing a deer’s head for the seventh day (Fig. 8, A to E). However, the Yucatek Mayan name *Manik’*, used by convention in the treatments of the ancient calendar, is of unknown origin and meaning but was the same name attested in Ch’olan Mayan as *Manich’*. Deer is 1 of 4 days of the Mesoamerican calendar on which the 365-day year could begin, known as a “Year Bearer.” With a numerical coefficient of 1 to 13, any combination of a number and a Year Bearer day served to designate a year, each individual example repeating every 52 years. One such Year Bearer date (3 Wind or 3 Ik’) has already been attested among the hieroglyphs of the later San Bartolo murals of the Sub-1A phase (2). It is therefore possible that 7 Deer refers to another such year date. It is also possible that 7 Deer served as a personal reference, since some

260-day stations are known to have been used also as names of people and deities in historical times.

During the Classic period, Maya scribes only rarely used the deer’s head as the glyph for seventh day. Instead, it was far more common to use a hand sign, showing the thumb and forefinger touching (Fig. 8, F and G). This can be explained by the hand sign’s established use in other settings as the phonetic sign **chi**, cuing the Ch’olan Mayan word *chij*, “deer,” derived from proto-Mayan *\*kehj* (13). This reflects the status of Ch’olan as a prestige language and script, used even among non-Ch’olan communities in the Maya lowlands (14). Its first attested use as the day Deer comes in the Early Classic period (200 to 500 CE), and it emerged as the established form during the entire history of the Maya script. This standardization of the **chi** hand was so entrenched that, in later periods, it came to be “fossilized” by Yucatecan speakers in the sixteenth century, whose word for deer was *keej* and whose name of the seventh day was *Manik’*. Throughout the Late Classic (550 to 850 CE) and Postclassic periods (900 to 1500 CE), the **chi** hand remained the prevalent



means of writing the day, although the phonetic motivation behind its use was probably lost, even among those literate in the writing system. This leads us to believe that the use of the deer's head at San Bartolo, at ~300 to 200 BCE, may represent an early stage in Maya script development before the purely phonetic **chi** hand emerged as the standard Ch'olan form of the sign.

**DISCUSSION**

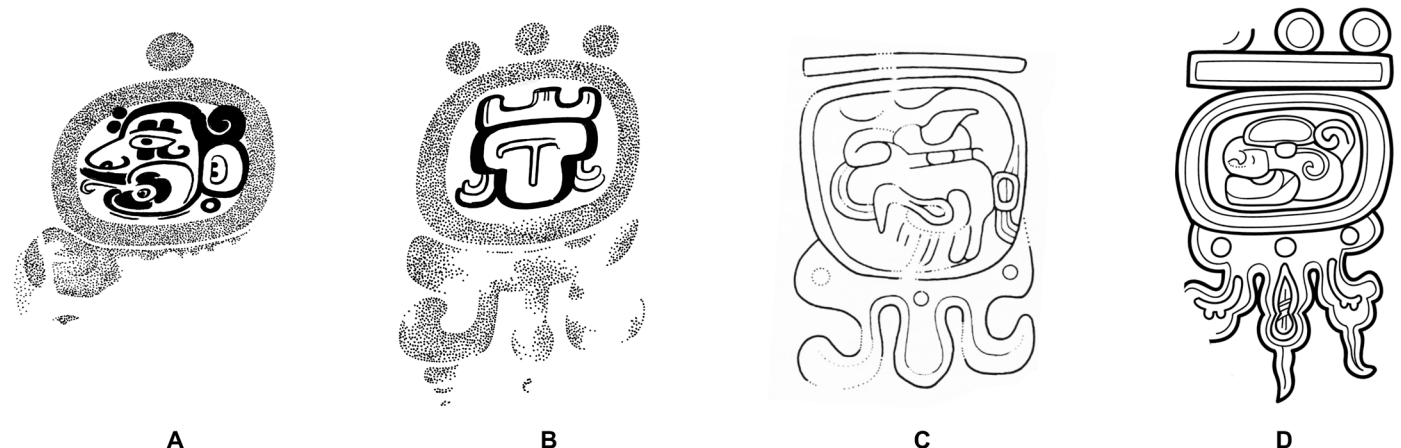
Leaving aside the linguistic issues surrounding the appearance of the 7 Deer glyph, we emphasize that the key point that San Bartolo mural fragment #4778 is a very rare example of a clear hieroglyphic date from the Late Preclassic period. Only a handful of date records

from this time frame are known in the Mesoamerican archaeological record, with many of them difficult to date with any precision.

One supposed early hieroglyphic day sign comes from a ceramic seal from the San Andres, Tabasco, dated to ~650 BCE and identified by its excavators as bearing a Maya hieroglyphic day 3 Ajaw in the 260-day calendar (15). They argue that this is a key piece of evidence in tracing early Olmec writing in the Gulf Coast region. Although the dating seems secure, we disagree with the identification of the day glyph due to the equal possibility that it is an iconographic design, not in any way textual. Both the supposed numeral and the form of the day sign are open to other interpretations. At present, there are no unequivocal examples of date records from "Olmec" sources, even on objects that may bear examples of "proto-writing"

**Table 2. Mesoamerican Late Preclassic date records.** Comparison of 260-day inscriptions in tentative relative ordering found in carved and painted artifacts.

Site	Long Count	Calendar round	Correlation (range)	Archaeological dating	Culture
San Bartolo Fragment #4778	–	7 Deer (Manik')	–	ca. 300–200 BCE	Maya
Chalchuapa, Monument 2	7.?.?.?.?	?	(354 BCE to 41 CE)		Maya?
Kaminaljuyu, Stela 10	–	7 Kimi	–	ca. 100–1 BCE	Maya
Kaminaljuyu, Stela 10	–	8 Ix	–	ca. 100–1 BCE	Maya
Izapa, Monument 40	–	7 Kimi	–	ca. 100–1 BCE	Maya?
Jaina, Panel 3	–	5 Imix?	–	ca. 100–1 BCE	Maya
San Bartolo, Sub-1A east	–	1 Ajaw?	–	ca. 100–1 BCE	Maya
San Bartolo, Sub-1A west	–	3 Ik'	–	ca. 100–1 BCE	Maya
San Jose Mogote, Monument 3	–	1 Movement	–	ca. 100–1 BCE?	Zapotec
Chiapa de Corzo fragment	7.16.3.2.13	6 Reed (Ben) 16 Xul	8 December, 36 BCE		Isthmian
Tres Zapotes, Stela C	7.16.6.16.18	6 Knife (Etz'nab) 1 Uo	3 September, 32 BCE		Isthmian
La Mojarra, Stela 1	8.5.3.3.5	13 Snake (Chikchan) 3 Kayab	20 May, 143 CE		Isthmian
La Mojarra, Stela 1	8.5.16.9.7	5 Deer (Manik') 15 Pop	12 July, 156 CE		Isthmian



**Fig. 9. Comparative early day signs in Maya writing.** (A and B) 1 Ahau(?) and 3 Ik', San Bartolo, Str. Sub-1A; (C) Jaina, Panel 3; (D) Kaminaljuyu, Monument 10. Drawings by David Stuart, Nikolai Grube, and Lucia Henderson.

(16–18). Another proposed Middle Preclassic example of a 260-day calendrical date is from the Oaxaca Valley, on Monument 3 from San Jose Mogote, identified as “1 Movement” (19, 20). The stone was initially dated to 700 to 500 BCE, with claims that the date glyph must be the first documented use of the 260-day system. Several authors have questioned this date, argued for a later placement in the Terminal Preclassic, in Early Monte Alban II, after about 100 BCE (21–24).

With the exception of San Bartolo, all early calendar records come from stone monuments, most of which are fragmentary and/or difficult to assign chronologically. The earliest firmly identified Long Count date in Mesoamerican comes from Chiapa de Corzo, Mexico, corresponding to 37 BCE, using a “6 Reed” glyph for the corresponding day in the 260-day system. This text is probably in the so-called Isthmian or Epi-Olmec script, not Maya writing. Later examples of Isthmian dates come from monuments at the end of the Late Preclassic (or Terminal Preclassic period, 100 BCE to 200 CE), at La Mojarra and Tres Zapotes (25). Very early but incomplete Long Count dates in the Maya region are attested on Stela 2 at Takalik Abaj, corresponding to ca. 41 CE or later, and on the recently found Monument 2 from Chalchuapa, placed between 353 BCE and 41 CE (26, 27).

Early examples of dates using the 260-day calendar appear at several sites in the both highlands and lowlands. In the highlands and Pacific slope, these include examples on stone monuments at Izapa and Kaminaljuyu. Each of these monuments records a date in the 260-day calendar, yet tying them to an accurate date in our Gregorian calendar is not possible in the absence of Long Count dates (Table 2). Now, archaeological evidence and refined radiocarbon chronology points to a date of ~100 BCE for those monuments bearing hieroglyphic writing, including 260-day calendar signs, such as Izapa Monument 40, Kaminaljuyu Monument 10, and Takalik Abaj Stela 12 (27–29). The monuments from the Esperanza phase, including Kaminaljuyu’s Monument 10, probably date many centuries later than once thought and are now most accurately placed at about ~100 BCE (27, 28). The dates for Izapa’s relief sculpture have been a point of recent debate. Only one stone, Monument 40, bears a date glyph, 7 Cimi, that is clearly in the same tradition as those already discussed. Whereas Rosenswig (30) places many Izapa sculptures in the Guillén phase (300 to 100 BCE), Inomata and Henderson (28, 29) make a good case for them being somewhat later. Monument 40 itself is difficult to assign any specific date. In summary, chronological refinements still prevent us from dating any of the calendar records from Izapa, Takalik Abaj, or Kaminaljuyu before approximately 100 BCE.

In the Maya lowlands, 260-day calendrical dates from the Late Preclassic period are found in only lowland two sites, at San Bartolo and Jaina. At San Bartolo, two date signs were painted in the murals from the Sub-1A mural chamber of the Pinturas complex: one possibly identifiable as 1 Ajaw and the other as 3 Ik’ in the sacred 260-day system (Fig. 9, A and B). Located in a sealed deposit, the Sub-1A calendar dates were likely painted ~100 BCE, later than the Ixbalamque fragments discussed here. A very similar day sign appears on Panel 3 at Jaina, Campeche, reused in a Late Classic construction dating to 600 to 900 CE (Fig. 9C) (31). Those authors analyze the glyph as the day 5 Imix, although the identification of the day sign remains difficult. With the Jaina stone having been reused in a later context, its dating cannot be very precise, yet the style of the sign nonetheless indicates that it is Late Preclassic in date, ca. 100 BCE, comparable to the later San Bartolo forms and to the similar examples from Kaminaljuyu and Izapa (Fig. 9D). The San Bartolo Sub-V fragments

were recovered from a sealed context about 150 years earlier than Sub-1A (Fig. 2 and Table 2), with radiocarbon analysis dating the 7 Deer glyph fragment between 300 and 200 cal BCE. This provides a uniquely secure date for the 7 Deer glyph and its accompanying fragments, before most if not all Mesoamerican stone monuments known for their early date records.

The dating of the San Bartolo fragments indicates that the 260-day calendar was present in the lowland Maya region around the beginning of the Late Preclassic period. Moreover, we surmise that this system of day reckoning was already in use for some time, leading up to the third century BCE. The mural fragments document a robust scribal tradition with multiple hands and styles of writing that demonstrate a local community of scribes (Figs. 3 to 5), and the level of San Bartolo paint technology paired with the combination of text and figure all points to a mature art and writing tradition in the lowlands during the third century BCE. The evidence now suggests that we can no longer single out one region of Mesoamerica such as Oaxaca as “the” point of origin for scripts or calendrical record keeping. The situation would point to an even earlier origin of the calendar sometime during the Middle Preclassic, if not before, although the evidence remains indirect.

Given the ambiguities of dating those numerous stone monuments in nonsealed contexts, we believe that the 7 Deer date at San Bartolo, recovered in a sealed context, should be considered among the earliest evidence of the Mesoamerican 260-day calendar, if not the earliest. It is chronologically anchored by calibrated radiocarbon dates to 300 to 200 BCE, a relatively accurate “first” for the 260-day calendar and demonstrating its antiquity and its persistence in the Maya region over at least 23 centuries. The San Bartolo 7 Deer fragment among the larger corpus of Sub-V text and figural mural fragments is important early evidence of the 260-day ritual or divinatory calendar in the Maya area associated with an archaeologically excavated ritual complex. In contrast to the large masks of the Sub-V radial temple and the public spectacle that would be associated with its ballcourt, the small size and variety of the Sub-V painted texts require intimate engagement and are in scale with codices or small objects better known from much later periods. The San Bartolo mural corpus and its context provide rare evidence for both public and highly specialized practices of Late Preclassic period Maya religion.

The 260-day calendar has long been a key element in the traditional definitions of Mesoamerica as a cultural region, and its persistence in many communities up to the present day stands as a testament of its importance in religious and social life. Our ability to trace its early use back some 23 centuries stands as another testament to its historical and cultural significance.

## MATERIALS AND METHODS

This study reports on 11 fragments of ancient Maya wall painting that are part of the larger San Bartolo mural fragment corpus, a collection of approximately 7000 mural fragments excavated from the Las Pinturas structure at the archaeological site of San Bartolo, Petén, Guatemala. All mural fragments were recovered from sealed contexts during investigations by the San Bartolo-Xultun Regional Archaeological Project (PRASBX) between 2002 and 2012; records of provenience, associated ceramic materials, artifacts, and stratigraphic information for each fragment’s depositional context have been carefully maintained (table S3 and data S1 and S2). From 2012 to 2018, study and conservation activities pertaining to the corpus

took place both on site and in the project laboratory. During this time, efforts to reassemble fragments and digitize the collection resulted in the identification of the 7 Deer day sign.

The chronology of the Sub-V mural fragments with text is important to the invention and use of writing, calendrical notation, and iconographic elements found in Maya lowland art. This is relevant to broader questions in Mesoamerican archaeology regarding the origins of writing and the likely scenario that no one location can lay claim to its invention. By characterizing examples from securely dated contexts, such as those from San Bartolo, we can document variance in the development of writing across Mesoamerica. In evaluating the chronology of the San Bartolo corpus, we include the analysis of accelerated mass spectrometry (AMS) radiocarbon dates of 10 samples processed by Beta Analytic in 2005, and two new dates obtained from samples analyzed at the University of Arizona AMS Facility in 2020. All data values are included in the Results and/or the Supplementary Materials; no samples produced outlier dates. All AMS radiocarbon results presented are calculated using IntCal 20 calibration data; we used Bayesian statistics incorporating information on stratigraphic relationships processed using the OxCal 4.4.4 computer program (32, 33). The stratigraphic assumptions made for this model are visualized in Fig. 2, described in the text, and reported in data S3. The Bayesian analysis does not alter radiocarbon dates, rather it narrows the probability distribution within a stratigraphic horizon (34, 35). In this study, the successive construction floors of Las Pinturas defined clear relationships for grouping samples; however, Bayesian analysis does not address external factors, such as the use of recycled materials or stratigraphic mixing. For this reason, our model includes multiple samples from each stratigraphic context that were collected from separate areas within an architectural phase and we assumed that old wood and charcoal pieces were likely used in new construction fills to be conservative in our modeled dates for the Sub-V texts.

## SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at <https://science.org/doi/10.1126/sciadv.abl9290>

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**Acknowledgments:** We thank members of the San Bartolo archaeological project who have contributed to this research over many years, especially to those who conducted the excavations of the tunnels within the Pinturas complex including A. G. Cunil and F. Quixchan, M. Urquizú (project codirector), and P. R. Castillo (laboratory director). We thank A. Bass, Y. Cifuentes, and R. Beaubien for the conservation of the Ixbalamque mural fragments and D. Aquino and the Museo Nacional de Antropología y Etnología de Guatemala for ongoing curation of the San Bartolo mural fragment corpus. We also thank the Guatemalan Ministerio de Cultura y Deportes, Instituto de Antropología e Historia, and Departamento de Monumentos Prehispánicos for the support. In addition, we would like to thank the reviewers of an earlier version of this manuscript, who offered many constructive and useful comments. **Funding:** National Endowment for the Humanities grant RZ-50086 (to W.S.); National Endowment for the Humanities grants RZ-51575 and FT-61149-13 (to H.H.); National Geographic Society, Committee for Research and Exploration grants 7065-01, 7222-02, 7393-03, 7601-04, and 7721-04 (to W.S.); National Geographic Society, Committee for

Research and Exploration grant HJ-158C-17 (to W.S. and H.H.); American Council of Learned Societies, Burkhardt Fellowship (to H.H.); Foundation for the Advancement of Mesoamerican Studies Inc. grants 01038 and 02039 (to W.S.); Rust Family Foundation grant (to H.H.); Skidmore College Faculty Development funding (to H.H.); Annenberg Foundation (to W.S.); and Reinhart Foundation (to W.S.). **Author contributions:** Conceptualization: W.S., H.H., D.S., and B.B. Methodology: D.S., W.S., H.H., and B.B. Investigation: B.B., W.S., H.H., and D.S. Visualization: H.H. and D.S. Funding acquisition: W.S. and H.H. Project administration: W.S., H.H., and B.B. Supervision: W.S., H.H., and B.B. Writing—original draft: D.S. and H.H. Writing—review and editing: H.H. and D.S. **Competing interests:** The authors declare that they have no competing interests. **Data and materials availability:** All data needed to evaluate the conclusions in the paper are present in the paper and/or the Supplementary Materials.

Submitted 13 August 2021

Accepted 9 February 2022

Published 13 April 2022

10.1126/sciadv.abl9290