Supplementary Materials for

An early Maya calendar record from San Bartolo, Guatemala

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Data S1. Provenance.
Following the initial discovery of the site of San Bartolo located in the northeastern area of the Petén district of Guatemala, various areas of the Pinturas complex were excavated by the San Bartolo-Xultun Regional Archaeological Project (PRASBX) between 2002 and 2012, a research project with annual permits from Guatemala’s Ministry of Culture and Sports and the Vice-ministry of Cultural and Natural Patrimony. The Sub-IV to Sub-VII phase carbon samples (Beta-206575 to -578; Beta-206624; AA-114621 and -622) reported in this study were excavated by Boris Beltrán between 2005 and 2010 (5); the Sub-I phase carbon samples reported in this study (Beta-193509 to -13) were excavated by Diane Davies and Jessica Craig in 2003 and 2004, respectively (36, 37). Following each excavation season all cultural materials and samples were transferred from archaeological site to the project laboratory in Antigua, Sacatepequez, Guatemala for study, curation, and storage. A group of 10 carbon samples were exported to the U.S. radiocarbon dating laboratory Beta Analytic, Miami, Florida in 2005. The two additional samples included in this study that were excavated in 2010, were stored in the project laboratory in Guatemala until they were exported to the U.S. for radiocarbon analysis at the University of Arizona AMS lab in 2020.

Relevant to this study are the eleven mural fragments with text associated with the Sub-V phase Ixbalamque structure. Between 2002-2012, PRASBX excavated five buried architectural contexts associated with wall paintings within the early phases of the Las Pinturas pyramid. While all in situ murals were stabilized and conserved on site, all broken mural fragments that were deposited by the Maya in antiquity were collected for further study. This collection, known as the San Bartolo Mural Fragment Corpus, is comprised of approximately 7000 mural fragments excavated from the early phases of Las Pinturas, Structure 1. The twelve fragments from the Sub-V phase were excavated by Boris Beltrán in 2005 and 2008. Following transport to the project laboratory, these artifacts were curated by Heather Hurst between 2009-2018, which included digital scanning, photography, housing, and labeling. The Sub-V mural fragments were stabilized and partially reassembled by conservators Rae Beaubien (previously of the Smithsonian Institution), and Angelyn Bass (University of New Mexico); in this process, the painted surfaces were dry cleaned only. All fragments were re-imaged following conservation. In 2018, the San Bartolo Mural Fragment Corpus was transferred to collections storage of the Museo Nacional de Arqueología y Etnología, Guatemala City, with registration completed in Sept. 2019 [inventory numbers MUNAE 26931 – 33539].
Data S2. Summary of mural fragment contexts, Sub-V phase.
Of the nearly 7000 broken mural pieces recovered during archaeological excavations of the Las Pinturas pyramid, the majority of fragments are associated with the penultimate phase, namely the Ixim temple, the Sub-1A chamber, and the Sub-1B chamber. However, a group of 275 fragments of architectural plaster were recovered during excavations of the Las Pinturas, Sub-V phase buildings; of these, 249 fragments have painted or incised figural and/or textual elements. The surface area of an individual fragment ranges from \( <1 \text{ cm}^2 \) to \(~1500 \text{ cm}^2 \), and some fragments can be reassembled, such as the two fragments of #4777, and fragment #6375 joins with fragment #6376. Eleven individual fragments associated with the San Bartolo, Las Pinturas, Sub-V phase have text; the excavation contexts, artifact dimensions, and stylistic attributes of these eleven plaster fragments with text are summarized in Table S1.

Data S3. Methods and reporting of radiocarbon sampling establishing chronology of the Las Pinturas architectural sequence.
The Las Pinturas complex has seven major architectural phases that frequently incorporated multiple buildings within each phase (Fig. 2). Over the course of excavations (2002-2012), this architectural sequence has been revised and refined since its original reporting (1, 3), including two revisions summarized here. The architectural profile documents a division between the Sub-I phase defined by the construction of the mural chamber (Structure Sub-1A) and nearby building Sub-1B both at plaza level (not shown), and the Sub-II phase defined by the eastern face of the large platform (Yaxche) and the temple at its summit (Ixim). However, excavations revealed that the Sub-II phase complex was in use at the same time as the Sub-I phase architecture added to the eastern plaza. The penultimate phase of the ritual complex includes both Sub-I and Sub-II constructions. In the final phase of construction (Sub-0), an eastern rear wall of the final pyramid that engulfs the entire penultimate complex was built and then rebuilt; this modification present on the east side is not seen in the stairway or architecture of the western façade and it represents a sub-phase, likely needed to stabilize the final platform construction and does not merit a stand-alone phase designation.

A total of twelve radiocarbon samples are reported in order to establish an absolute chronology for the construction sequence of Las Pinturas (see sample locations in Fig. 2; see data analysis in Table S2 and S3). All samples are measured on carbonized wood collected from undisturbed contexts. We include the analysis of accelerated mass spectrometry (AMS) radiocarbon dates of ten samples processed by Beta Analytic in 2005, and two new dates were obtained from samples analyzed at the University of Arizona AMS Facility in 2020. All results presented are calculated using IntCal 20 calibration data and processed using the OxCal 4.4.4 computer program (32, 33).

In our analysis, several stratigraphic contexts of the previously reported dates were revised based on greater understanding of architectural relationships in the subsequent years of excavations. In the earlier reporting of two samples, Beta-193512 and Beta-193513, their context was ascribed to Final Phase construction (Sub-0) (3). However, upon review of the original field notes and photographs, these two samples were collected from beneath a floor just outside the mural chamber’s southwest doorway; the samples Beta-193512 and Beta-193513, are now assigned to the construction, (or terminus post quem), of the Sub-1A mural due to their context beneath a sealed floor shared by the mural chamber, associated with fill material above bedrock (36). A second refinement in the reporting of the radiocarbon dates is the division of two samples associated with the occupation/termination of the Sub-V platform Ixbalamque (loci 4 and 5 in
Figure 2), from two samples collected from the Sub-IV fill (loci 6 and 7 in Figure 2). The samples Beta-206624 and Beta-206578 were both collected from amidst the fallen wall stones of the Ixbalamque superstructure in association with other plain and painted blocks. In the 2006 reporting, these are assigned to the Sub-IV phase, but it was noted as likely that they originated with the construction materials and were redeposited with the destruction of its walls (3). Given the likelihood of these carbonized wood samples originating in construction or skewing earlier due to the maturity of the tree, Beta-206624 and Beta-206578 are assigned to Sub-V, rather than Sub-IV.

In 2020, with the opportunity to analyze additional samples, we selected carbon from the construction of the Sub-V radial temple and the Sub-IV fill material that covered it in order to have a comparison across the entire E-group, which had not yet been excavated in 2006. The new samples, AA-114621 and AA-114622, were selected from twig charcoal to minimize the likelihood of dating old wood to the extent possible. One new sample, AA-114621, and one previous sample, Beta-206575, date the general construction fill of Sub-IV from both the west and east areas of the Sub-V complex that was covered by the large pyramid base. The addition of sample, AA-114622, from beneath a floor associated with the Sub-V radial temple, similarly aimed to enlarge our sample size associated with Sub-VI and Sub-VII phases in order to consider the full extent of the E-group architecture.

Although the results have significant overlap, a clear division between Sub-V and Sub-I phases (and their associated murals) is present (Fig 2, Table S2 and S3). A Bayesian approach for radiocarbon calibration analysis (34, 35) further refines the probability of the date range for the Las Pinturas construction sequence (Table 1). For this study, we used Bayesian statistics incorporating information on stratigraphic relationships using the OxCal 4.4.4 computer program (32, 33). In this process, we grouped the contexts in order to best assess the probability for dates associated with Sub-V construction, Sub-V use/termination, and Sub-IV construction across the architectural complex associated with these phases. The model also groups three samples associated with the Sub-I construction with one sample collected from burned material within the chamber with the assumption this may be older wood, and one sample is from the final phase (Sub-0) of construction. The Bayesian model indicates that all of the Sub-V texts were likely painted and incised between 300 and 200 B.C., with greatest probability being the latter-half of the third century B.C.
Table S1: San Bartolo, Las Pinturas, Sub-V mural fragments with text

| Fragment # | Type of fragment | Style       | Quantity (n=11) | Context                | Location description                             | Dimensions     |
|------------|------------------|-------------|----------------|------------------------|--------------------------------------------------|----------------|
| #515       | plaster          | red line text | 1              | SB-1A-24-14            | 4.5 m north of building Ixbalamque, level of plaza| 2.3 x 3.8 cm   |
| #516       | plaster          | red line text | 1              | SB-1A-24-14            | 4.5 m north of building Ixbalamque, level of plaza| 2.5 x 3.0 cm   |
| #517       | plaster          | red line text | 1              | SB-1A-24-14            | 4.5 m north of building Ixbalamque, level of plaza| 6.9 x 6.6 cm   |
| #518       | plaster          | red line text | 1              | SB-1A-24-14            | 4.5 m north of building Ixbalamque, level of plaza| 6.2 x 6.9 cm   |
| #4777      | plaster          | black line text | 2              | SB-1A-34-VE3           | Ixbalamque, descanso on west side, near southwest corner of superstructure | 4.1 x 4.3 cm   |
| #4778      | plaster          | black line text | 2              | SB-1A-34-VE3           | Ixbalamque, descanso on west side, near southwest corner | 5.9 x 8.8 cm   |
| #6366      | block            | black line text | 1              | SB-1A-34-19            | Ixbalamque, descanso, south end                  | 45 x 25 x 26 cm |
| #6367      | block            | incised     | 1              | SB-1A-34-10            | Ixbalamque, descanso near 4 stairs on east side, south end | 21 x 25 x 28 cm |
| #6375      | block            | black line text | 1              | SB-1A-34-VE2           | Ixbalamque, descanso at the southwest corner of superstructure | 55 x 27 x 27 cm |

**Table S1. Sub-V mural fragment contexts.** Description of excavation context, attributes, and dimensions of eleven mural fragments with text that are associated with the Sub-V phase, Ixbalamque architecture.
Table S2. Unmodeled radiocarbon plots from Las Pinturas, San Bartolo. Unmodeled radiocarbon plots of twelve samples associated with San Bartolo, Las Pinturas. Bars indicate 95.4% probability ranges; all dates are measured on carbonized wood.
Table S3. Expanded list of contexts for radiocarbon samples from Las Pinturas, San Bartolo. List of calibrated radiocarbon dates, contexts, and associated ceramic materials of the twelve samples from San Bartolo, Las Pinturas, presented in this study.

| Sample # | 14C age BP | 14C age - 95% RANGE | Calibration Program | Context # and Description | Excavator, Year | Associated Ceramic Types |
|----------|------------|---------------------|---------------------|---------------------------|-----------------|------------------------|
| AA-114622 | 2246 +/- 47 | 395 to 195 BC | IntCal20, OxCal v4.4.4 | SA-1A-34-B-1. Collected from undisturbed deposit below floor of Sub-V phase radial pyramid “Hunchos” and stone bedrock. | B. Beltrán, 2010 | No ceramics; materials collected include bone, obsidian, and shell. |
| Beta-205676 | 2200 +/- 40 | 400 to 200 BC | IntCal20, OxCal v4.4.4 | SA-1A-32-3. Collected from undisturbed deposit between floors of phase Sub-VI and Sub-VII platforms “Timucine” and “Loqui”. | B. Beltrán, 2005 | Achiote sin engobe; V. Achiote; Zapote estradado; V. Zapote; Achiote con bañada V. No esp. | |
| Beta-205677 | 2200 +/- 40 | 390 to 60 BC | IntCal20, OxCal v4.4.4 | SA-1A-32-7. Collected from an undisturbed deposit within the floor of the Sub-V platform “Tabalampas”. | B. Beltrán, 2005 | Achiote sin engobe; V. Achiote; Zapote estradado; V. Zapote; Tierra mojada resist; V. Tierra mojada; Sierra roja; V. Sierra; Sierra verde inciso; V. Laguna; Achiote sin estrados V. Achiote; Mateo; Diego compuesto V. Diego; Flor Crema V. Indet. | Bosque café; V. Bosquey |
| Beta-205678 | 2180 +/- 40 | 370 to 105 BC | IntCal20, OxCal v4.4.4 | SA-1A-34-5. Collected from an undisturbed deposit on the surface of the stairs of the Sub-V “tabalampas” platform in direct association with mural fragments; likely that it originated with the construction materials and was redeposited with the destruction of its walls. | B. Beltrán, 2005 | Achiote sin engobe; V. Achiote; Zapote estradado; V. Zapote; Achiote con bañada V. No esp. | Bosque café; V. Bosquey; San Antonio café dorado; V. San Antonio |
| AA-114621 | 2150 +/- 47 | 360 to 55 BC | IntCal20, OxCal v4.4.4 | SA-1A-34-78.1. Collected from fill covering the south façade mask of Sub-V “Hunchos”; dates the termination of Sub-V architecture and the construction of Sub-IV phase architecture. | B. Beltrán, 2010 | NA |
| Beta-205675 | 2150 +/- 40 | 350 to 50 BC | IntCal20, OxCal v4.4.4 | SA-1A-24-7. 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. | B. Beltrán, 2005 | No ceramics; however, levels 34-9 and 34-11 both had Middle Preclassic (Mamom) and Late Preclassic (Chicanel) diagnostic material. |
| Beta-195509 | 2140 +/- 40 | 355 to 45 BC | IntCal20, OxCal v4.4.4 | SA-1A-11-6. Removed from within the plaster matrix of the in situ. Str. Sub-1A mural; dates the construction of the Sub-1A chamber. | D. Davies, 2003 | NA |
| Beta-195512 | 2100 +/- 40 | 345 BC to AD 10 | IntCal20, OxCal v4.4.4 | SA-1A-17-6. Collected from undisturbed deposit below floor of Sub-I phase construction; test pit located immediately outside southern door of Structure Sub-1A. | J. Craig, 2004 | Achiote sin engobe; V. Achiote; Sierra roja; V. Sierra |
| Beta-195513 | 2050 +/- 40 | 170 BC to AD 60 | IntCal20, OxCal v4.4.4 | SA-1A-17-6.1. Collected from undisturbed deposit below floor of Sub-I phase construction; test pit located immediately outside southern door of Structure Sub-1A. | J. Craig, 2004 | Achiote sin engobe; V. Achiote; Sierra roja; V. Sierra |
| Beta-195510 | 2070 +/- 40 | 195 BC to AD 25 | IntCal20, OxCal v4.4.4 | SA-1A-21-B-8. Collected from a deposit of charred material upon the floor at the base of the west wall of Sub-1A mural chamber. | J. Craig, 2004 | Achiote sin engobe; V. Achiote; Zapote estradado; V. Zapote; Sierra roja; V. Sierra; Laguna verde inciso; V. Laguna; Polvero Negro; V. Polvro |
| Beta-195511 | 1990 +/- 50 | 195 BC to AD 110 | IntCal20, OxCal v4.4.4 | SA-1A-11-6-1. Collected from the final construction material within the Structure Sub-1A mural chamber. | D. Davies, 2003 | Sierra roja; V. Sierra; Polvero Negro; V. Polvro |
Figure S1. Sample AA-114622, collected from undisturbed deposit below floor of Sub-V phase radial pyramid "Hunahpu" and above bedrock.
Figure S2. Sample Beta-206576, collected from undisturbed deposit between floors of phase Sub-VI and Sub-VII platforms "Ixmucane" and "Ixquik".
Figure S3. Sample Beta-206577, collected from an undisturbed deposit within the floor of the Sub-V platform "Ixbalamque".
Figure S4. Sample Beta-206624, 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.
Figure S5. Sample Beta-206578, 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.
Figure S6. Sample AA-114621, 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.
Figure S7. Sample Beta-206575, 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.
Figure S8. Sample Beta-193509, removed from within the plaster matrix of the in situ Str. Sub-1A mural; dates the construction of the Sub-1A chamber.
Figure S9. Sample Beta-193512, collected from undisturbed deposit below floor of Sub-I phase construction; test pit located immediately outside southern door of Structure Sub-1A.
Figure S10. Sample Beta-193513, collected from undisturbed deposit below floor of Sub-I phase construction; test pit located immediately outside southern door of Structure Sub-IA.
Figure S11. Sample Beta-193510, collected from a deposit of charred material upon the floor at the base of the west wall of Sub-1A mural chamber.
Figure S12. Sample Beta-193511, collected from the Final phase construction material within the Structure Sub-1A mural chamber.
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