AMS 14C Dating of Residential Construction & Occupation at the Ancient Maya Townsite of Alabama, East-Central Belize

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Problem: Chronology Building

Traditional methods of chronology building in Maya Archaeology have **limited utility** at the ancient Maya townsite of Alabama due to:

- complex earthen-core architecture with minimal refuse within platform cores
- soil conditions resulting in poorly preserved ceramic assemblages
- A flat radiocarbon calibration curve in the Late to Terminal Classic transition.

Objectives: Settlement Growth Processes

In this study, we attempt to 1) **develop directly dated sequences for residential constructions and occupations**, and 2) **analyze these sequences within a Bayesian statistical framework**, as a way of circumventing the above-mentioned issues with chronology building at Alabama.

Figure 1. Map of central Belize showing location of Alabama[2].

Figure 2. Excavating at ALA-045A (left) and ALA-045B (right).

Context: Alabama Townsite

This ancient Maya "boomtown" of East-Central Belize (Figure 1), named after a 1950s banana plantation barracks (ancient name unknown), was constructed and occupied primarily during the transition between the Late Classic to Terminal Classic periods (ca. AD 700-900).[1] Occupation extended into Early Postclassic (AD 900-1200) in some portions of the settlement.[2] Approximately 1000 people lived at Alabama, based on our recent settlement survey and population calculations. The archaeological site lies adjacent the present-day village of Maya Mopan (estb. 1975) in the Stann Creek District. We have been conducting research at Alabama since 2014 (Figure 2).

Methods: AMS 14C Dating & Bayesian Modelling

We chose two residential mounds in group ALA-047 to test Bayesian chronological modelling.[3] Bayesian chronological models combine probability distributions from radiocarbon dates with ***prior*** information from the archaeological record (e.g., stratigraphy, ceramic sequences). Our methods followed these steps:

- **Collected** seven carbon samples from stratigraphically ordered contexts in test excavations at ALA-047A (n = 3) and ALA-047B (n = 4). These were **submitted** for AMS ^{14}C analysis (Table 1).
- **Developed** Bayesian chronological models using OxCal 4.4 to create ordered sequences for their construction and occupation histories.[4-7]
- **Created** uniform and Charcoal Outlier models (see QR code) to **test** for difference outcomes.
- **Modelled** strata that separate directly dated deposits as boundaries (events not directly dated) and modelled groups of dates within a phase (i.e., unordered samples from construction core).
- **Placed** boundaries at the start and end of each sequence
- **Identified** outlier dates and problematic prior assumptions when agreement fell below a critical value (*A'c = 60*).[4]

Lab #	Material	^{14}C age (BP)	Unmodeled 2σ cal range (prior)
ALA-047A			
UOC-16244	Charcoal	900 ± 25	AD 1045-1086 (30.1%); AD 1092-1105 (3.3%); AD 1120-1218 (62.1%)
Beta-457817	Charcoal	1360 ± 30	AD 607-623 (3.4%); AD 637-691 (76.2%); AD 697-702 (0.9%); AD 741-774 (14.9%)
UOC-16248	Charcoal	1260 ± 30	AD 668-778 (74.6%); AD 786-830 (17.3%); AD 854-874 (3.5%)
ALA-047B			
UOC-16245	Charcoal	975 ± 25	AD 1021-1054 (28.9%); AD 1064-1158 (66.6%)
UOC-16246	Charcoal	1050 ± 30	AD 895-925 (11.0%); AD 949-1035 (84.5%)
Beta-456254	Charcoal	1260 ± 30	AD 668-778 (74.6%); AD 786-830 (17.3%); AD 854-874 (3.5%)
UOC-16316	Bulk sediment	1290 ± 35	AD 657-777 (91.1%); AD 791-821 (4.4%)

Table 1. Calibrated AMS ^{14}C dates for ALA-047. Calibrated with OxCal 4.4[4] using the IntCal20 northern hemisphere atmospheric radiocarbon calibration curve[8].

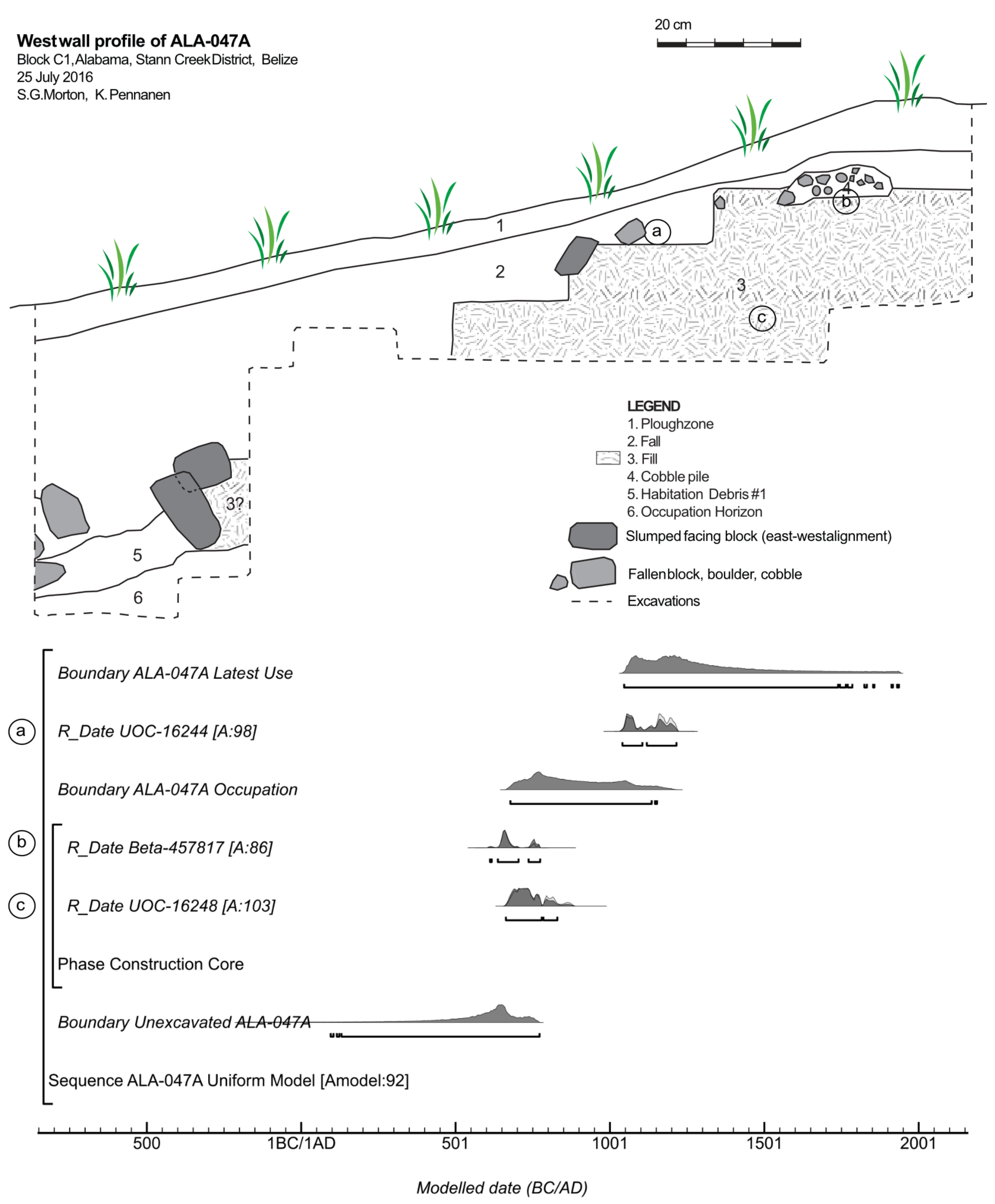

Figure 3. Profile and Bayesian model of ALA-047A (modelled in OxCal 4.4[4]).

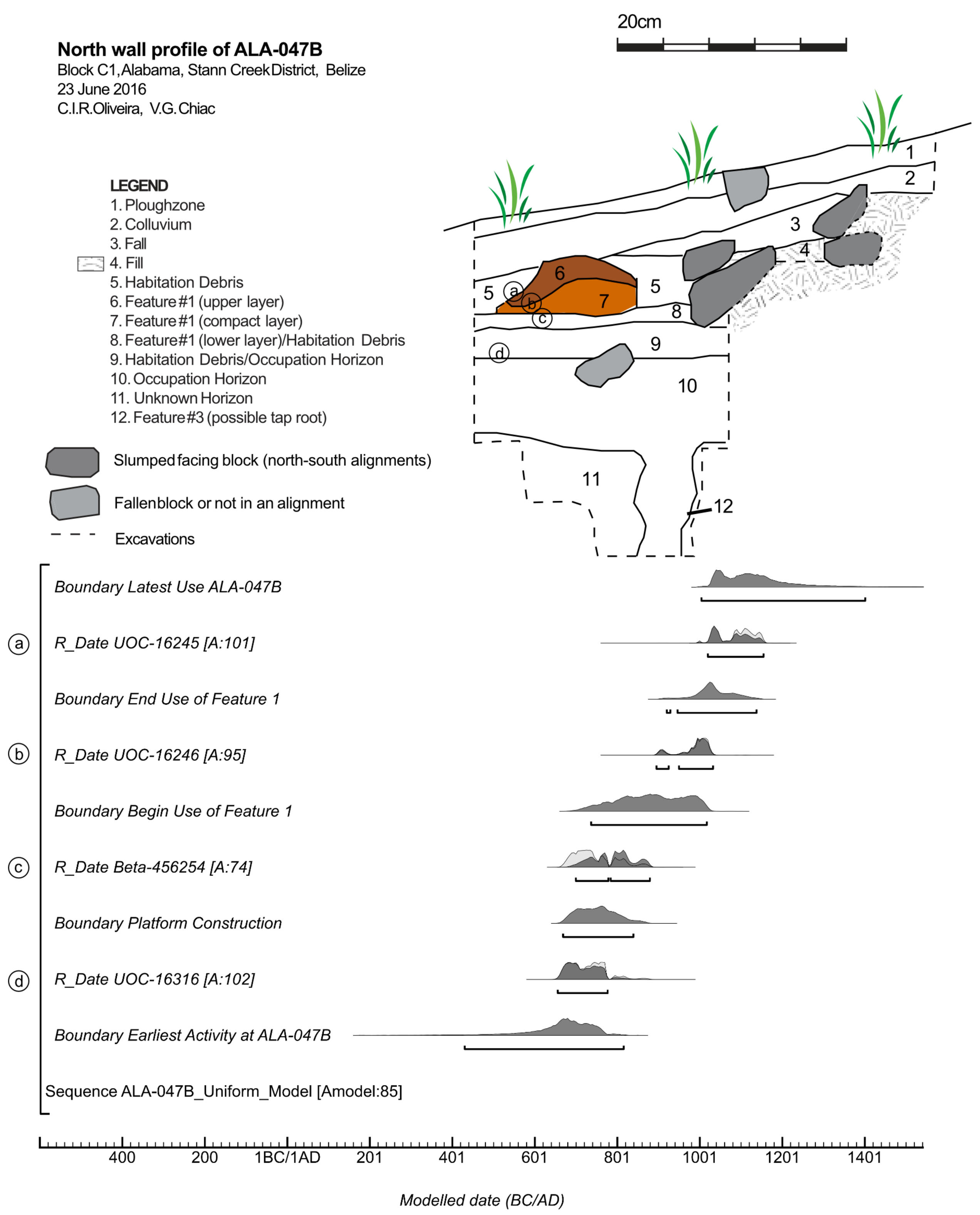

Figure 4. Profile and Bayesian model of ALA-047B (modelled in OxCal 4.4[4]).

Results: Bayesian Sequence Models

ALA-047A (Figure 3): Overall Agreement Index (*A-model*) = 92. Start (cal AD 114-773) and end (cal AD 1045-1937) boundaries are poorly constrained (few priors available).

- Model indicates carbon samples from construction core date between **cal AD 613-775** and **cal AD 663-866**. These dates reflect the timing of burning the wood in a secondary location rather than the construction event. Charcoal was likely deposited with quarried earthen material during construction. This dates platform construction to some point in the late facet of the Late Classic or Terminal Classic periods (~AD 675-900). Modelling suggests the platform was in use between **cal AD 679-1156**; the start of this range is likely too early. The final AMS ^{14}C date range in the model is **cal AD 1041-1216**, derived from charcoal associated with structure collapse or terminal habitation debris. Ceramics recovered from this context support this Early Postclassic (AD 900-1200) date range.

ALA-047B (Figure 4): Overall Agreement Index (*A-model*) = 85. Start (cal AD 425-815) and end (cal AD 1001-1402) boundaries are relatively well constrained.

- A ^{14}C date from the occupation horizon level that extends beneath the platform dates to between **cal AD 656-777**. Builders then constructed the platform atop this surface between **cal AD 670-839**. During occupation, residents pushed habitation debris off the platform, between **cal AD 700-880**, based on a ^{14}C date. They then constructed or deposited an enigmatic daub feature atop this debris between **cal AD 736-1018**. A ^{14}C sample from this feature indicates it was used between **cal AD 896-1033**, a date supported by the limited associated ceramics. The feature was no longer in use between **cal AD 920-1139**. Debris associated with the terminal occupation, accumulated atop and to the side of the feature, dates to between **cal AD 1021-1155**, supported by associated ceramics.

Conclusions

- Carbon recovered from within earthen-core platforms **does not provide accurate age** determinations for construction. However, precision may improve when we include additional priors, especially ^{14}C dates from stratigraphic contexts above and below (i.e., underlying occupation horizons, habitation debris above).
- Samples selected from habitation contexts (e.g., habitation debris) or prepared occupation surfaces provide **the most accurate age determinations** to date occupation contexts.
- When preserved, **pottery checks accuracy and allows greater precision** of ^{14}C date ranges.
- Outlier models (see *QR code*) provide **negligible differences** in posterior probabilities or Agreement Indices.

Scan to learn more

Works Cited

1. Peuramaki-Brown, M. M. (2017). Revisiting the Ancient Maya of Alabama, Belize: Description, Recent Research, and Future Directions. Mexicon 39:64–72.; **2.** Peuramaki-Brown, M. M., Morton, S. G. (2019). Maya Monumental "Boom": Rapid Development, Hybrid Architecture, and "Pretentiousness" in the Fabrication of Place at Alabama, East-Central Belize. Journal of Field Archaeology 44(4):250–266.; **3.** Morton, S. G, et al. (2016). The 2016 Settlement Investigations: Operation 2 at ALA-047. In The Stann Creek Regional Archaeology Project: Report of the Third (2016) Field Season, edited by M. M. Peuramaki-Brown, pp. 27–68. Athabasca University, Alberta.; **4.** Bronk Ramsey, C. (2009). Bayesian Analysis of Radiocarbon Dates. Radiocarbon 51(1):337–360.; **5.** Bayliss, A. (2015). Quality in Bayesian Chronological Models in Archaeology. World Archaeology 47(4):677–700.; **6.** Hamilton, W. D., Krus, A. M. (2018). The Myths and Realities of Bayesian Chronological Modeling Revealed. American Antiquity 83(2):187–203.; **7.** Culleton, B. J. et al. (2012). A Bayesian AMS 14C Chronology of the Classic Maya Center of Uxbenká, Belize. Journal of Archaeological Science 39(5):1572–1586.; **8.** Reimer, P. J., et al. (2020). The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). Radiocarbon 62(4):725–757.