Modeling the Introduction of Brown Ware and Red Ware in the Mogollon Early Pithouse Period

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INTRODUCTION

The introduction of ceramics marks the beginning of the Early Pithouse period, traditionally defined as A.D. 200-550 (Anyon et al. 2010), in the Mogollon region. Various terms are used to identify this early ceramic period in the different Mogollon branches (Diehl 2007); however, for this poster, the phrase Early Pithouse will be used throughout. The Early Pithouse period is represented by two ceramic wares: plain brown ware and early red ware (red-slipped pottery). Generally, three types of plain brown ware are identified for the period: Alma Rough (unpolished), Alma Plain (polished), and Alma Textured (scored, punched, or incised) (Haury 1936; Martin 1943). It is believed that the production of plain brown ware began around A.D. 200-300 in the Mogollon region (LeBlanc 1982); however, given the lack of formative/experimental stages of pottery production, fully developed pottery technology was likely imported into the region (LeBlanc 1982; Martin 1959). Less is known about the production of the red ware during this period. Haury (1936) initially assigned the name San Francisco Red to the red-slipped pottery. San Francisco Red is believed to have been produced around A.D. 550 to 1000; however, pottery with some degree of red slip, but not the other traits of San Francisco Red have been found in pre-A.D. 550 contexts (Anyon et al. 2001; LeBlanc 1982; Scott 1983). To add to the confusion, this early red ware has been labelled various terms, such as San Francisco Red, Saliz variety (Martin 1943); Miscellaneous Red (Anyon and LeBlanc 1984; Saliz Red (LeBlanc 1982); Mogollon Early Red (Anyon et al 2001); or just San Francisco Red (e.g. Fitting 1973). It is currently unknown when the production of this early red ware began.

RESEARCH OBJECTIVE

- **Use Bayesian chronological models of radiocarbon and tree-ring dates to examine different possible scenarios for the timing of the introduction of plain brown ware and early red ware ceramics in the Mogollon Early Pithouse period.**

DATA COLLECTION

- A comprehensive list of 203 radiocarbon and tree-ring dates from sites/structures dating to the end of the Late Archaic/Early Agricultural period and the Early Pithouse period in the Mogollon region (Mimbres, Reserve, Forestdale, and Point-of-Pines branches only) was compiled from published and unpublished sources. In addition, 7 new radiocarbon dates submitted by the author were added to the list.
- Selection of the dates to be used in the Bayesian models was based on the following:
  - Pithouse (habitation or communal) structures only. No dates were used from extramural structures/features.
  - Except for the pre-pottery sites/structures, ceramic data (counts by at least wares) needed to be available at the structure level for each pithouse used.
  - Only conventional (corrected) radiocarbon ages were used. Uncorrected dates were not used.
  - Dates that had been previously rejected as "old wood" were not used.
  - Only cutting dates were used for the tree-ring dates.
- A total of 46 radiocarbon and tree-ring dates (See supplemental text) from 16 sites (Figure 1) were selected for the models.

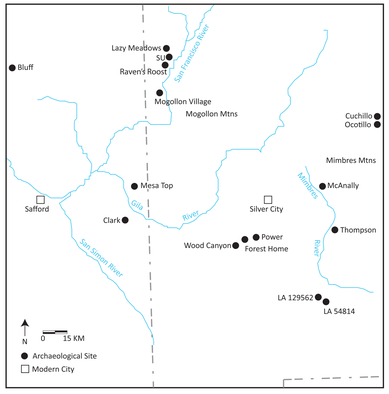

Figure 1. Map of the Mogollon Early Pithouse site used in this study.

- All radiocarbon dates were recalibrated using the most recent calibration curve, IntCal13 (Reimer et al. 2013) in OxCal v. 4.2.4 (Bronk Ramsey 2009a).
- Structures were assigned to one of three phases: Pre-pottery (no associated ceramics), Brown ware (plain brown ware only, no associated red ware), and Red ware (early red ware ceramics present) (Figure 2).
- The assignment to a phase was based on dates, ceramic data, and the original interpretation of the structure/site by the excavator.

MODELING METHODS

- The dates were modeled according to the principles of Bayesian statistics in OxCal 4.3.1 (Bronk Ramsey 2009a), which produces statistical date estimates referred to as *posterior density estimates* (Bayliss 2007).
- To examine different scenarios for the introduction of plain brown ware and early red ware, four Bayesian models were constructed: a contiguous and overlapping phase model framework (Bronk Ramsey 2009a) each with a uniform phase prior and a trapezoidal phase prior (Lee and Bronk Ramsey 2012).
- Explanation of the four models:
  1) **Contiguous phase/uniform phase prior** – one phase ends as another begins with the new phase appearing suddenly
  2) **Contiguous phase/trapezoidal phase prior** – one phase ends as another begins with the new phase appearing gradually
  3) **Overlapping phase/uniform phase prior** – one phase may continue simultaneously as another phase begins with the new phase appearing suddenly
  4) **Overlapping phase/trapezoidal phase prior** – one phase may continue simultaneously as another phase begins with the new phase appearing gradually.
- Each model was run with all the selected dates and short-lived specimen and tree-ring dates only.
- For models with all selected dates used, an outlier model [Outlier_Model ("Charcoal")] (Bronk Ramsey 2009b; Dee and Bronk Ramsey 2014) was applied to the conventional radiocarbon dates on wood charcoal to mitigate potential old wood issues.
- Any outliers (a date with agreement index less than 60%) produced in the models were evaluated individually (see Table 1 and supplemental text).

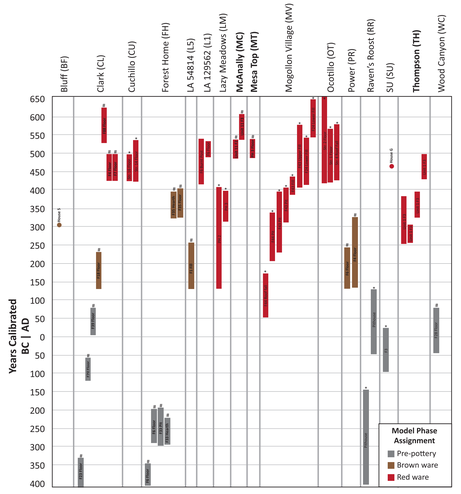

Figure 2. Tree-ring and calibrated ^{14}C dates of 46 samples from 16 sites. Sites are arranged in alphabetical order. Sites listed in bold indicated new AMS dates added. Each bar depicts a single ^{14}C measurement at the 1 σ range (for visual representation only). Circles depict tree-ring dates. Bars/circles are colored according to assigned model phase (see legend). Short-lived ^{14}C samples have a "#" after the bar. Conventional 14C samples on wood charcoal have an "*" after the bar. An outlier removed from all the models has an "x" after the bar.

RESULTS

Table 1. Introduction of brown ware and red ware as calculated according to the different models.

Model	Data Type	Agreement [A_{model}]	Outliers*	INTRODUCTION OF BROWN WARE		INTRODUCTION OF RED WARE	
				Modeled Date (Highest Posterior Density Estimate)		Modeled Date (Highest Posterior Density Estimate)	
				95% probability	68% probability	95% probability	68% probability
Contiguous/uniform	A	91%	MV F24 Beta-47210 (removed)	***AD 58-303***	***AD 102-225***	***AD 299-360***	***AD 299-325***
Contiguous/uniform	S	92%	MC U11 D-AMS-059858 (below 60% and not removed)	***6 BC-AD 235***	***AD 54-174***	***AD 347-471***	***AD 402-456***
Contiguous/ trapezoidal	A	101%	MV F24 Beta-47210 (removed)	Initial ***138 BC-AD 251*** Established ***AD 61-299***	Initial ***AD 11-172*** Established ***AD 118-244***	Initial ***AD 179-352*** Established ***AD 303-507***	Initial ***AD 238-318*** Established ***AD 348-458***
Contiguous/ trapezoidal	S	98%	None	Initial ***181 BC-AD 235*** Established ***AD 20-347***	Initial ***2 BC-AD 165*** Established ***AD 75-238***	Initial ***AD 278-460*** Established ***AD 345-519***	Initial ***AD 356-441*** Established ***AD 400-470***
Overlapping/uniform	A	80%	CL F18 Beta-202728 and FH F35 Beta-141722 (below 60% and not removed)	***AD 143-303***	***AD 276-303***	***AD 236-371***	***AD 268-332***
Overlapping/uniform	S	77%	CL F18 Beta-202728 and FH F35 Beta-141722 (below 60% and not removed); CL F88 Beta-202730 and MC U11 D-AMS-015958 (below 60% and removed)	***AD 141-303***	***AD 273-303***	***AD 360-477***	***AD 417-463***
Overlapping/ trapezoidal	A	90%	None	Initial ***AD 30-303*** Established ***AD 111-331***	Initial ***AD 249-303*** Established ***AD 212-309***	Initial ***AD 160-355*** Established ***AD 260-525***	Initial ***AD 225-314*** Established ***AD 308-460***
Overlapping/ trapezoidal	S	74%	CL F88 Beta-202730 and MC U11 D-AMS-015958 (below 60% and not removed)	Initial ***AD 34-303*** Established ***AD 115-332***	Initial ***AD 246-303*** Established ***AD 214-309***	***Initial AD 342-476*** ***Established AD 386-519***	***Initial AD 410-461*** ***Established AD 429-470***

Data Type: A = all dates, S = short-lived and tree-ring dates only

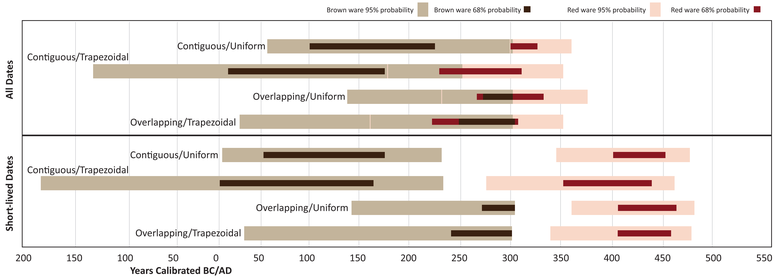

Figure 3. Summary of the results of the Bayesian models for the introduction of brown ware and red ware. Note: for the trapezoidal phase prior models, the initial start date was used.

DISCUSSION/CONCLUSION

- In general, the models support a start date prior to A.D. 300 for the introduction of brown ware.
- If the Mogollon Early Pithouse period began as the Late Archaic/Early Agricultural period ends (contiguous phase), then the introduction of brown ware likely began prior to A.D. 200. However, if the Late Archaic/Early Agricultural period continued as the Early Pithouse period began (overlapping phase), then the introduction of brown ware likely began after A.D. 200.
- Given that all brown ware phase dates are short-lived samples, there is little to no difference between the model results for the introduction of brown ware between models run on all the dates and models run on short-lived and tree-ring dates only.
- When all dates are used, there is a major old-wood effect (at least 100 years or more) on the red ware phase even with using the "charcoal" outlier submodel analysis (Bronk Ramsey 2009b).
- Based on the models conducted on short-lived and tree-ring dates only, it is likely that the introduction of early red ware began after A.D. 400.
- **As with all models, the results of these models must be viewed with caution.** In general, the sample sizes (especially for short-lived specimens) is small and the distribution of structures/sites is limited. Furthermore, it is unlikely that the introduction of brown ware and red ware was uniform across the Mogollon region.
- New dates on short-lived specimens are needed, particularly from sites where only conventional radiocarbon dates on wood charcoal exist. New dates from McAnally and Mesa Top highlight the potential of using existing collections to get new dates.
- To gain a better understanding of the early red ware, a more consistent typology is needed. Clear definitions of early red ware and San Francisco Red need to be made.
- As the database of Early Pithouse period dates and ceramic data expands, Bayesian chronological models hold great potential to add to our understanding of the early ceramics in the Mogollon region.

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