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Toward a Regional Radiocarbon Model for the East Texas Woodland Period

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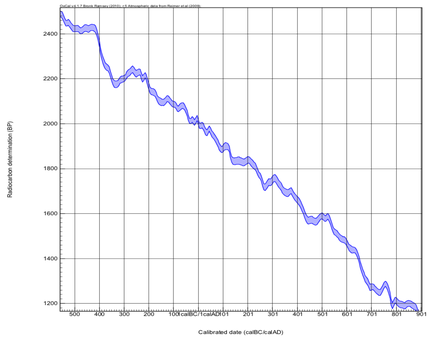
ABSTRACT

The East Texas Radiocarbon Database contributes to an analysis of tempo and place for Woodland era (ca. 500 B.C. - A.D. 800) archaeological sites within the region. The temporal and spatial distributions of calibrated radiocarbon (^{14}C) ages (n=127) with a standard deviation (ΔT) of 61 from archaeological sites with Woodland components (n=51) are useful in exploring the development and geographical continuity of the peoples in East Texas, and lead to a refinement of our current chronological understanding of the period. While the analysis of the dates produces less than significant findings due to sample size, they are used here to illustrate the method of date combination prior to the production of site and period-specific summed probability distributions. Through the incorporation of this method, the number of ^{14}C dates is reduced to 85 with a ΔT of 54. The resultant data set is then subjected to statistical analyses which conclude with the separation of the East Texas Woodland period into the Early Woodland (ca. 500 B.C. – A.D. 0), Middle Woodland (ca. A.D. 0-400), and Late Woodland (ca. A.D. 400-800) periods.

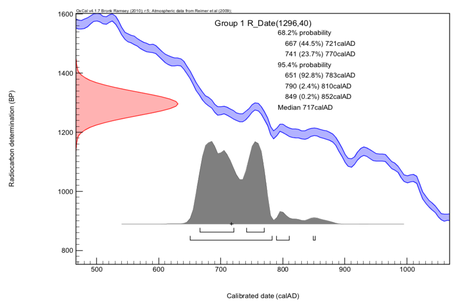
WOODLAND RADIOCARBON

Archaeologists have a lengthy history of tinkering with the manipulation of ^{14}C data, and have made much progress since first advocating for a more flexible method of processing data through the employment of a punch-card data retrieval system (see Taylor et al. 1968). The inductive methodology employed here informs a regional chronology for East Texas Woodland sites. The goals are to explore the process of ^{14}C date combination from sites with four or more samples (n=11) to decrease sampling bias for statistical analysis and determine the modified summed probability distributions (see Bamforth and Grund 2012, Michczynska and Pazdur 2004, Williams 2012), and secondly to employ the resulting median dates within a statistical analysis of regional trends.



^{14}C DATE COMBINATION

The date combination process assumes that if all assays collected at a particular site draw carbon from the same reservoir, then they should have the same underlying F14C value and can be combined prior to calibration (Bronk Ramsey 2008). The measurements have Gaussian uncertainty distributions, and were used to test the assumption that all ratios are the same to reveal whether compelling evidence exists – at the 95% confidence level – that dates cannot be related to the same event (Bronk Ramsey 2008). Each site-specific figure provides the SPDs, calibrated age range for combined assays, and all dates utilized to inform these results.



Calibrated results from the R_Combine function for 41DT16 Group 1.

CALIBRATION CURVE

Conventional ^{14}C dates used within the framework of this study were recalibrated using IntCal09. The curve serves as the basis for date calibration and can aid the process of archaeological interpretation by highlighting temporal zones with reversals and plateaus. Within the span of time assigned to the East Texas Woodland period (500 B.C. – A.D. 800), the curve can be seen to have three notable reversals of varying degrees (370-220 B.C., A.D. 240-340, and A.D. 680-780). There are also three plateaus within the curve (500-420 B.C., A.D. 140-210, and A.D. 430-540). While this does not produce clues regarding human behaviors, it does help to clarify why—even after combination—some date ranges have longer spans of probability for the calibrated date range.

$$A_p = \left(\sum_1^n A_i/E_i^2\right) / \left(\sum_1^n 1/E_i^2\right)$$

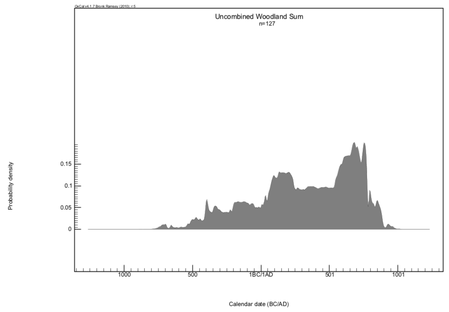
$$T = \sum_1^n (A_i - A_p)^2 / E_i^2$$

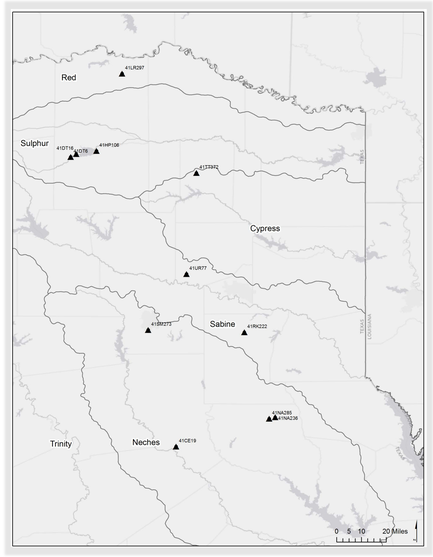
$$V(A_p) = \left(\sum_1^n 1/E_i^2\right)^{-1}$$

(Ward and Wilson 1978)

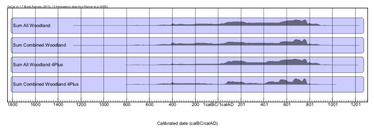
TEMPORAL RANGE OF OCCUPATION

The temporal character of Woodland occupations at the 11 sites with four or more ^{14}C dates have been dissected, then reassembled to illustrate the temporal range of occupations and hiatuses for each. The diversity of occupational length within the sample ranges from an average of 95-831 cal. ^{14}C years, with breaks that range from 0-382 cal. ^{14}C years. Of the 11 sites, one may have been continually if episodically occupied (41DT6), four have two discrete dated occupational events (41HP106, 41TT372, 41RK222, and 41CE19), and six have three discrete dated occupational events (41LR297, 41DT16, 41UR77, 41NA236, 41NA285, and 41SM273).

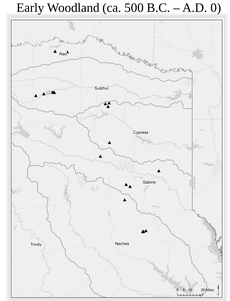




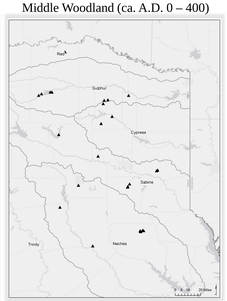
Through the date combination (R_Combine) process, the number of assays decreased from 127 to 85, which lowered the standard deviation for the combined group while reducing the number of median ages to be used in the statistical analysis. The SPD for the whole of the Woodland period was created using the revised (i.e., combined from sites with ≥4 ^{14}C assays) sample of 85 ^{14}C dates from 51 archaeological sites in East Texas. This representation of these data is not biased by sites with larger numbers of samples due to the date combination process. While not discussed here, those sites with <4 ^{14}C assays that conformed to methodological constraints were included in the Woodland SPD.



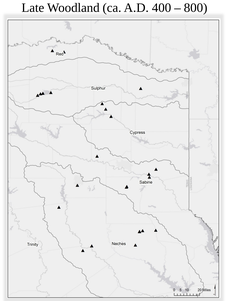
Early Woodland (ca. 500 B.C. – A.D. 0)



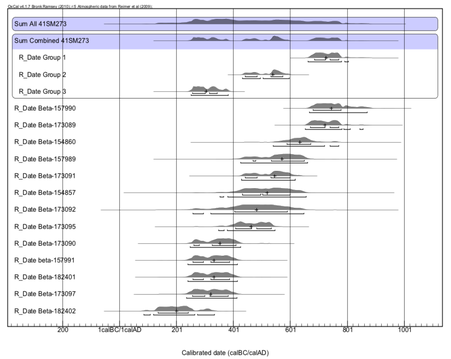
Middle Woodland (ca. A.D. 0 – 400)



Late Woodland (ca. A.D. 400 – 800)

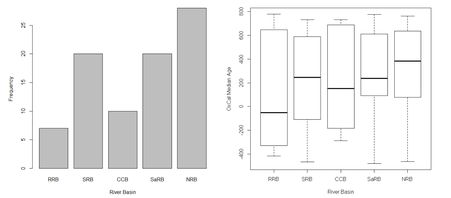


*References available upon request.



RESULTS

Although the number of sites is small, they highlight a possible temporal hiatus of nearly 400 years in the Red River basin, and another of nearly 200 years in the Cypress Creek basin, both of which appear here on the basis of data from one site in each river basin. The remaining peaks correlate with populations from the kernel density plot, and they illustrate a small peak in the Red River basin around 400 B.C. followed by slight increases in the dates from the Sulphur, Cypress, and Sabine basins around 200 B.C. This is prior to a 200-year peak in dates from the Sulphur and Sabine River basins for A.D. 50-220, after which a marked increase occurs in the number of dated Woodland sites for the Sulphur, Cypress, Sabine, and Neches River basins from A.D. 600-800.



CONCLUSIONS

We are quickly approaching an era where typological assignments can be associated with radiocarbon samples in this same manner, but significant advances in correlating these data with specific aspects of archaeological assemblages still need to be made as we progress in our analyses of the Woodland period of East Texas. This analysis represents only a small sample of ^{14}C dates from the ETRD, which remains a large and understudied amalgam of radiocarbon dates that is available for use within current cultural resource management endeavors. Through the systematic employment of this methodological approach, it is plausible that similar analyses would strengthen the arguments presented here (i.e., shorter hiatuses during the later and better-understood Caddo period, and longer hiatuses ranging from the Archaic through Paleoindian periods), providing a productive medium through which dialogues regarding the material culture of East Texas can continue to be developed.

BROADWAY SITE EXAMPLE

The 13 ^{14}C dates from the Woodland period occupation at the Broadway site were combined into three groups (Figure 12). Group 1 consists of two assays (Beta-157990 and Beta-173089), Group 2 has six assays (Beta-154860, Beta-157989, Beta-173091, Beta-154857, Beta-173092, and Beta-173095), and Group 3 has five assays (Beta-173090, Beta-157991, Beta-182401, Beta-173097, and Beta-182402). Group 3 dates from A.D. 257-344, Group 2 has an age range from A.D. 442-574, and Group 1 dates from A.D. 685-771, indicating a temporal hiatus of 98 cal. ^{14}C years between Group 3 and Group 2, and 111 cal. ^{14}C years between Group 2 and Group 1. Occupational periods span 87 cal. ^{14}C years, 132 cal. ^{14}C years, and 86 cal. ^{14}C years, respectively.

Occupations and hiatuses by river basin for sites with ≥4 ^{14}C dates.

River Basin	Site	O(1)	H(1)	O(2)	H(2)	O(3)	AOL	AHL
Red	41LR297	525	643	187	37	214	309	340
Sulphur	41DT6	831	--	--	--	--	831	0
	41DT16	357	413	140	93	103	200	253
	41HP106	150	287	196	--	--	173	287
Cypress	41TT372	191	337	106	--	--	149	337
Sabine	41RK222	167	218	333	--	--	250	218
	41URT7	161	330	82	343	82	108	337
Neches	41CE19	186	72	157	--	--	172	72
	41NA236	353	436	158	327	95	202	382
	41NA285	90	532	109	151	85	95	342
	41SM273	87	98	132	111	86	102	105

O = Occupation
H = Hiatus
AOL = Average Occupation Length
AHL = Average Hiatus Length

DISCUSSION

Due to depositional and contextual issues and the wide variety of mitigation strategies and research designs employed throughout the region, the western boundary of the Eastern Woodlands remains one of the least well-known and explored periods in the greater Southeast. This can be seen plainly when the number of components from Woodland period sites is contrast against the much more robust representation of radiocarbon dates from the Caddo period. The fact that only 127 of the 1248^{14}C samples in the East Texas Radiocarbon Database are representative of this period speaks to the need for further research.