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A DENDROARCHAEOLOGICAL APPROACH TO MISSISSIPPIAN CULTURE OCCUPATIONAL HISTORY IN EASTERN TENNESSEE, U.S.A.

SHANNON D. KOERNER[1], **HENRI D. GRISSINO-MAYER**[2]*, **LYNNE P. SULLIVAN**[3], and **GEORGINA G. DEWEESE**[4]

[1]Department of Anthropology, The University of Tennessee, Knoxville, Tennessee 37996, USA

[2]Laboratory of Tree-Ring Science, Department of Geography, The University of Tennessee, Knoxville, Tennessee 37996, USA

[3]Frank H. McClung Museum, The University of Tennessee, Knoxville, Tennessee 37996, USA

[4]Department of Geosciences, University of West Georgia, Carrollton, Georgia 30118, USA

ABSTRACT

We investigated the potential for using long-archived wood samples extracted from archaeological contexts at four Mississippian Period (AD 900–1600) settlements in eastern Tennessee for tree-ring dating purposes. Sixteen wood samples recovered from prehistoric sites were analyzed to: (1) crossmatch samples from each site with the intent of determining the relative chronological order of sites, (2) establish a floating prehistoric tree-ring chronology for eastern Tennessee, (3) determine the applicability of dendrochronology in prehistoric archaeology in eastern Tennessee, and (4) establish a strategy for future research in the region. We succeeded in crossmatching only three of the 16 tree-ring sequences against each other, representing two sites relatively close to each other: Upper Hampton and Watts Bar Reservoir. The average interseries correlation of these three samples was 0.74 with an average mean sensitivity of 0.26, and they were used to create a 131-year-long floating chronology. The remaining samples contained too few rings (15 to 43) for conclusive crossmatching. Our results demonstrate that dendrochronological techniques may be applied to the practice of prehistoric archaeology in the Southeastern U.S., but highlight the challenges that face dendroarchaeologists: (1) poor wood preservation at prehistoric sites, (2) too few rings in many samples, (3) the lack of a reference chronology long enough for absolute dating, and (4) the lack of a standard on-site sampling protocol to ensure the fragile wood samples remain intact.

Keywords: Dendrochronology, dendroarchaeology, tree rings, relative crossmatching, Mississippian Culture, Southeastern U.S.

INTRODUCTION

Archaeologists use the term "Mississippian" to refer to socially and politically complex societies that lived throughout the Southeastern U.S. between approximately AD 900 and 1600. The term relates to the geographic area of the Mississippi River Valley that initially was considered the core area of Mississippian cultures. Because more resources have been spent studying Mississippian period cultures than other periods in the Southeastern U.S., archaeologists have come to recognize the diversity inherent in these prehistoric societies. Based on worldwide ethnographic accounts of similar societies (Earle 1977; Peebles and Kus 1977; Steponaitis 1978), archaeologists have made inferences about the political structures of Mississippian societies. How social inequality and complex political forms were sustained and transferred, and the resulting stability of such organizations, are some of the topics studied by archaeologists in the Southeast.

Many of the identified Mississippian settlements are thought to be organized into hierarchical settlement patterns that may correlate with political formations known as "chiefdoms" (Steponaitis 1978). Simple chiefdoms are represented by one level of "administrative control" over a local population. Complex chiefdoms are represented by more than one level of "administrative control" over the local population. Administrative control levels are identified by settlement size and com-

* Corresponding author: grissino@utk.edu; Fax 865-974-6025; Telephone 865-974-6029

plexity. A site with a single residential platform mound and surrounding village would be a lower administrative center while a multiple platform mound and village site would be considered a higher administrative center. Large political centers maintained some level of control over the activities of subordinate (*i.e.* smaller) centers and outlying hamlets (Steponaitis 1978; Anderson 1994; Beck 2003). Chiefdom polities (administrative centers and outlying villages and hamlets/homesteads) are identified archaeologically through a hierarchical arrangement of synchronous mound and village site occupations in a region (Hally 1993, 1996). By organizing identified sites into polities, researchers have suggested long-term "cyclic" fluctuations in the stability of chiefdoms (Anderson 1994, 1996), which may represent competition between rival (and therefore contemporary) chiefdom polities.

A key problem with these interpretations is chronological control. Ceramic artifacts have long been the most reliable indicator of time and space relationships for prehistoric sites in the Southeastern U.S. (Holmes 1903; Harrington 1922). Prehistoric pottery seriations have been developed over the past 70 years as an aid in constructing regional cultural chronologies (Lewis and Kneberg 1946; Steponaitis 1983; Hally 1994; King 2004), but the calendrical dating of wood from prehistoric sites in the southeastern region would allow archaeologists to establish absolute chronological control of sites and develop tighter temporal control of associated artifact types. This study uses archaeologically recovered wood specimens from eastern Tennessee Mississippian sites to construct a prehistoric tree-ring chronology and to determine the relative timing of occupation for each site. The absence of a master tree-ring sequence that extends back to the Mississippian period constricts the emphasis here to crossmatching (rather than crossdating) each tree-ring sequence as floating chronologies (*i.e.* "relative" dating rather than "absolute" dating).

Dendroarchaeology in the Southeastern U.S.

Investigators have long suggested the possibility of dating Mississippian mounds via tree-ring counts on nearby old-growth trees. In 1798, the Reverend Manasseh Cutler wrote:

> "At the commencement of the settlement (at Marietta) the whole of these works were covered by a prodigious growth of trees… The only possible data for forming any probable conjecture respecting the antiquity of the works, I conceived, must be derived from the growth upon them. By the concentric circles, each of which contains the annual growth, the ages of the trees might be ascertained" (Cutler and Cutler 1987).

Similarly, Moorehead (1890, 1934) used tree-ring counts of hardwood trees to date site occupations at Mississippian mound sites in southern Ohio. Willey (1937: 6), however, was the first to suggest the application of more formalized tree-ring dating techniques to date Southeastern archaeological sites, "It is within the range of reason to hope that the wide chronological interval between prehistoric and modern can be thus bridged."

The earliest thorough attempts at establishing a long tree-ring chronology in the Southeast were conducted by Florence Hawley in the 1930s (Hawley 1938a, 1938b, 1938c, 1941). Hawley was one of the first archaeologists to learn dendrochronological techniques from A.E. Douglass at the University of Arizona in 1930 (Nash 1999). Fay-Cooper Cole at the University of Chicago was interested in applying dendrochronology in the Southeast, and had sent Hawley to work with the Tennessee Valley Authority (TVA) in 1934 to develop a living tree chronology for the Norris Basin in northeastern Tennessee (Hawley 1941; Nash 1999). After years of fieldwork collecting thousands of samples, Hawley was able to construct tree-ring chronologies for much of the Midwest and Midsouth (Hawley 1938c). Unfortunately, Douglass never approved Hawley's provisional dates for prehistoric sites in the Southeastern U.S. and would not let her publish them (Nash 1999). After further complications with Douglass and the TVA, Hawley left Tennessee in 1936 without establishing an accepted prehistoric tree-ring sequence (Nash 1999). The next person to publish results from dendrochronological investigations in the Southeast using crossdated tree-ring sequences would not do so for another 40 years (Stahle 1978, 1979).

Several investigations of historic sites in the Southeast have been successful in using tree rings to answer archaeological questions (Bell 1952;

Mann 2002; Reding 2002; Wight and Grissino-Mayer 2004; Grissino-Mayer and van de Gevel 2007). These studies show that dendrochronology is practical in the eastern United States but still requires similar master chronology building as was conducted previously in the Southwest. Hawley's initial study of eastern red cedar (*Juniperus virginiana* L.) provided the most promising direction for developing a living-tree chronology. Because of widespread clear-cutting in eastern forests for the past 250 years, it was difficult to find living-tree samples that could extend the tree-ring chronology back further than a few hundred years (Hawley 1941). In recent times, researchers have collected samples from historic structures (Mann 2002; Wight and Grissino-Mayer 2004) and subfossil wood (Stahle 1985) to extend Southeastern tree-ring chronologies back hundreds of years (ITRDB 2008).

East Tennessee Mississippian Culture

The Mississippian cultural sequence was developed by Tennessee archaeologists Thomas Lewis and Madeline Kneberg in the 1940s and is still used by archaeologists working in Tennessee today. The sequence is based primarily on excavations from the Chickamauga Basin in southeastern Tennessee (Lewis and Kneberg 1946; Lewis *et al.* 1995). The Hiwassee Island cultural phase was believed to represent the earliest expression of a Mississippian lifeway in eastern Tennessee. Settlement traits of this phase consist of rectangular wall trench structures, flat-top earthen habitation mounds, a noticeable absence of human burials, and shell-tempered pottery with a high incidence of loop-handled jars along with bowls, bottles, textile-impressed basins, and red-on-buff painted vessels (Lewis and Kneberg 1946, p. 173). Dallas cultural phase settlements, which succeeded Hiwassee Island phase occupations, are characterized by square and rectangular single-set post structures, a continued use of flat-top habitation mounds, an abundance of burials, along with shell-tempered pottery consisting of jars with strap handles, incised wares, effigy-modeled vessel forms, textile-impressed basins, and filleted-rim bowls and jars (Lewis and Kneberg 1946, p. 176). Mouse Creek cultural phase settlements, which overlap in time with Dallas phase sites in some areas, differed slightly in material culture. The main differences between the two phases were burial practices, structure variations, and the frequency of certain ceramic types. The residents of Mouse Creek phase settlements buried their dead in an extended position (opposed to the typically flexed Dallas burials), built rectangular semi-subterranean houses with attached rectangular open-air ''summer'' structures, did not construct earthen mounds, and possessed a ceramic industry that lacked cordmarked and textile-impressed wares (Sullivan 1986, 1987; Lewis *et al.* 1995, p. 21).

Table 1. East Tennessee Mississippian Chronology (after Kimball and Baden, 1985).

Cultural Phase	Date Range (AD)
Martin Farm	900–1000
Hiwassee Island	1000–1300
Dallas/Mouse Creek	1300–1600
Overhill Cherokee	1600–1838

A more recent organization of the Mississippian ceramic assemblages from eastern Tennessee into a chronological sequence was based primarily on recovered ceramic potsherd data and new information from excavations in the Little Tennessee River Valley (Kimball and Baden 1985; Schroedl *et al.* 1985). Temporal units were statistically defined by site ceramic artifact counts and related radiometric dates. Mississippian temporal units I–IV were defined by the presence of distinct ceramic tempering and surface treatments and assigned to broad temporal ranges (Table 1). The earliest Mississippian ceramic assemblages were designated as Mississippian I (Martin Farm phase, AD 900–1000), with subsequent temporal units Mississippian II (Hiwassee Island phase, AD 1000–1300), and Mississippian III (Dallas/Mouse Creek phases, AD 1300–1600). Each of these cultural phases spatially encompasses all of eastern Tennessee and, excluding Martin Farm, is allocated to temporal ranges between two and three hundred years in duration. This temporal and spatial resolution is not satisfactory for the study of prehistoric socio-political interactions.

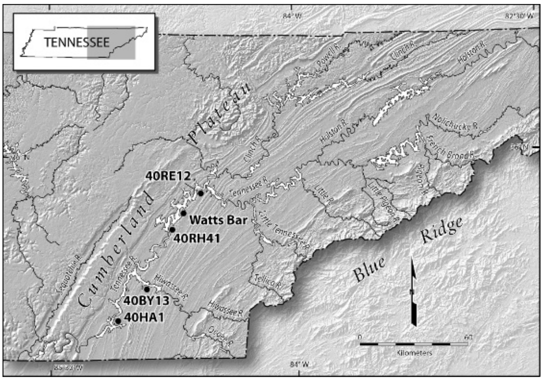

Figure 1. Sites used in the study: 40HA1 (Dallas), 40BY13 (Ledford Island), 40RH41 (Upper Hampton), and 40RE12 (DeArmond). The location for the Watts Bar Reservoir sample is approximate because no provenience information was found.

Cultural phases need to be redefined by shorter time spans and parceled spatially into distinct subareas so that cultural influence may be more precisely recognized.

SITE DESCRIPTIONS AND SAMPLES

Four Mississippian Period sites in eastern Tennessee were included in the study. Three sites are located on the Tennessee River in Hamilton, Rhea, and Roane counties, and one is on the lower Hiwassee River, a tributary of the Tennessee River, in Bradley County (Figure 1). All potential wood specimens from each of the four sites were identified in the collections at Frank H. McClung Museum at the University of Tennessee. Many curated specimens were unsuitable for dendrochronological testing, but we did find sixteen samples of intact wood and charcoal that could be analyzed for this study (Table 2).

The Dallas site (40HA1) was located on the east bank of the Tennessee River, about 4 km (2.5 mi) upriver from the town of Harrison in Hamilton County (Lewis *et al.* 1995, p. 305). This Dallas phase town was excavated between November of 1936 and March of 1937 by the TVA and consisted of a platform mound and residential area. The site has been AMS dated to 540 ± 60 yr BP (cal. AD 1410) and 560 ± 30 yr BP (cal. AD 1405) for the terminal occupation, which ended with the burning of the town (Sullivan 2007). Two burned wood specimens of oak (*Quercus* L.) of the white oak group were found in the site collections. Sample HA1-352 (Field Specimen 352) was recovered from Stratum III, the terminal occupation level of the site that was burned. Sample number HA1-44 (Field Specimen 44) was also recovered from Stratum III.

The Ledford Island site (40BY13) was located on Ledford Island in the Hiwassee River about 9.5 km (6.0 mi) downriver from the town of Charleston in Bradley County (Lewis *et al.* 1995, p. 523). This large town was excavated between May 1938 and March 1939 by the TVA. The site is characterized as a Mouse Creek phase occupation and has been radiocarbon dated to 450 ± 50 yr BP (cal. AD 1445) (Sullivan 1986). Two intact wood specimens of pine (*Pinus* L.), tentatively identified as shortleaf pine (*Pinus echinata* Mill.) based on physical ring characteristics, were found in the site collections. Both samples came from Feature 36, a large community structure 14 m × 14 m (46 ft × 46 ft) in size on the north end of an open plaza area. The size of the structure and its placement near the town plaza indicates that it was a public building (Sullivan 1995). It also had been re-built

Table 2. Site information and wood specimens analyzed in this study.

Site (Name)	Radiocarbon Ages for Site	Sample Identification (species)	Provenience
40HA1 (Dallas)	540 ± 60 yr BP	HA1-44 (oak of the white oak group)	Stratum III
	560 ± 30 yr BP	HA1-352 (oak of the white oak group)	
40BY13 (Ledford Island)	450 ± 50 yr BP	BY13-F36a, b (pine, likely shortleaf pine)	Structure 36
40RH41 (Upper Hampton)	620 ± 40 yr BP	RH41-S12a, b, c, d, e (pine, likely shortleaf pine)	Structure 12
	640 ± 40 yr BP	RH41-DS16, 17, 18 (pine, likely shortleaf pine)	Unknown
		RH41-922 (pine, likely shortleaf pine)	Plowzone
40RE12 (DeArmond)	640 ± 50 yr BP	RE12-DS5, 17 (eastern red cedar)	Mound Level D
Watts Bar Reservoir	None	REWATT (pine, likely shortleaf pine)	Unknown

in the same location multiple times (Sullivan 1986, 1987; Lewis *et al.* 1995, p. 529).

The Upper Hampton site (40RH41) was located on the west bank of the Tennessee River about 13 km (8.0 mi) upriver from the town of Spring City in Rhea County (Walker n.d.). The site was excavated between October of 1940 and January of 1941 by the TVA and consisted of a small village surrounded by a defensive ditch. The site has been characterized as a protohistoric Mouse Creek phase occupation (post-AD 1540) based on the presence of a semi-subterranean house pattern and European trade objects (Polhemus 1985). But, the site collections have never been intensively studied or a report published. The presence of a Dallas phase component also is likely at Upper Hampton based on inspection of the ceramic collections and from two AMS radiocarbon dates from wood charcoal samples. The first sample, from Structure 12, had a conventional age of 620 ± 40 (cal. AD 1310, AD 1360, or AD 1390). Structure 12 is characterized as a square residential structure measuring 7 m (23 ft) on a side. The second sample was from a post mold that could not readily be associated with a structure. It had a conventional age of 640 ± 40 (cal. AD 1300, AD 1360, or AD 1380). Nine intact wood specimens of pine (again, tentatively identified as shortleaf pine based on physical ring characteristics) were found in the site collections. Five samples (numbered RH41-S12a through RH41-S12e) were recovered from Structure 12, one sample (number RH41-922) from the plow zone, and three other samples (numbered RH41-DS16 through 18) from unknown contexts.

The DeArmond site (40RE12) was located on the east bank of the Tennessee River, 8.0 km (5.0 mi) downriver from Kingston in Roane County (Alden n.d.). This town site was excavated between February 1940 and March 1941 by the TVA and consisted of a platform mound and adjacent residential area. The mound was characterized by both Hiwassee Island and Dallas phase occupations (Koerner 2005) and has been AMS dated to 640 ± 50 yr BP (cal. AD 1305) for the terminal Hiwassee Island phase occupation level (Level E). No absolute dates have been determined for the uppermost Dallas phase levels of the mound (Levels A through D). Two intact wood specimens of eastern red cedar were found in the site collections. Sample RE12-DS5 was recovered from the mound fill of Level D, which directly overlies the terminal Hiwassee Island phase level of the mound (Level E). Sample RE12-DS17 also was recovered from mound Level D, but was taken from Structure 8 of that level. One pine sample (likely shortleaf pine) was found in the collections from the Watts Bar Reservoir, but could not be tied to a particular site. Watts Bar Reservoir lies approximately between sites 40RE12 and 40RH41 (Figure 1). This sample was labeled REWATT and tested pending further findings on the spatial placement of the particular sample.

METHODS

Sixteen samples were considered for analysis, 14 intact wood samples and 2 carbonized samples. The 14 intact wood specimens were prepared for dating by cutting a transverse section of the sample and sanding the surface starting with ANSI 100-grit (125–149 μm) and ending with ANSI 320-grit (32.5–36 μm) (Orvis and Grissino-Mayer 2002). After all wood samples were sanded, the tree rings were dotted starting at year "1" for the first complete ring and subsequently marking each decade ring. To facilitate easier dating and measurement of the tree rings from the charcoal samples, the charcoal was broken in half to create a "clean" surface and then covered with talcum powder (Douglass 1941). The white powder settled into the open cells of each ring, increasing the contrast between the earlywood and latewood.

Each tree ring was then measured to the nearest 0.001 mm using a Velmex measuring system interfaced with Measure J2X measuring software. Each of the 16 measured tree-ring series was then statistically crossmatched against each other as undated series using the COFECHA software package to plot the relative positions of each sample in time (Holmes 1983; Grissino-Mayer 2001). We generally tested 40-yr segments lagged either 20 or 10 years, depending on the length of the series being tested. Testing shorter segment lengths with considerable overlap enables more detailed diagnostics in COFECHA for testing crossmatching accuracy (Grissino-Mayer 2001). To be considered crossmatched, the majority of segments tested had to correlate significantly ($p < 0.01$) with the already-dated series in COFECHA (Grissino-Mayer 2001). When a series was significantly correlated, the starting year for the sample was adjusted relative to the other series using the EDRM program (Holmes 1992). After the tested series were crossmatched relative to each other, the composite series was tested again using COFECHA at 40-yr segments with a 20-yr overlap (Grissino-Mayer 2001).

If significant correlation coefficients were found, we then compared the suggested crossmatching of individual series using both skeleton plots and scatter plots. The statistical match suggested by COFECHA had to be convincing graphically as well as statistically (Grissino-Mayer 2001). We realize this sequence (statistical followed by graphical crossmatching and confirmation) is opposite to the sequence often employed when dating floating tree-ring sequences (graphical followed by statistical crossmatching), but we argue that the former sequence is more expedient and provides the same results as the latter sequence, especially when conducting relative tree-ring dating on species that usually have few problematic rings, such as pine and oak that grew in low-lying valleys. If we had more than one juniper sample, however, we first would have attempted graphical crossmatching between samples.

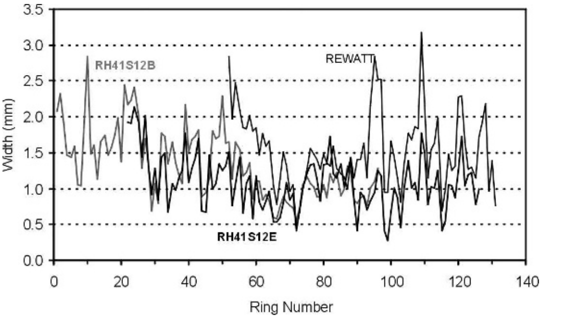

Figure 2. Relative dating for pine samples RH41S12B (thick gray line) and RH41S12E (thick black line) from the Upper Hampton site, and REWATT (thin black line) from the Watts Bar Reservoir area.

RESULTS AND JUSTIFICATION

Pine samples RH41S12B and RH41S12E from the Upper Hampton site crossmatched against each other statistically ($r = 0.70$, $n = 75$ years overlap, $t = 8.37$, $p < 0.0001$) and graphically (Figure 2), suggesting these two samples may represent the same tree, or at least two trees growing close to each other. We next crossmatched pine sample REWATT from Watts Bar Reservoir (with 80 rings) against the dated pine samples from the Upper Hampton site, and found a statistically significant correlation at relative ring position 52 ($r = 0.71$, $n = 75$ years overlap, $t = 8.61$, $p < 0.0001$) (Figure 2). We next considered pine sample RH41-922 (representing 43 rings), again from the Upper Hampton site, and found a systematic dating adjustment (average r-value for all 4 segments = 0.56) of +69 years (beginning year = ring 70). The interseries correlation of this series with the samples already dated was 0.58 ($n = 43$, $t = 4.56$, $p < 0.0001$). Despite the convincing statistical and graphical crossmatching, we nonetheless felt that the number of rings was too few for the series to be crossmatched.

Oak sample HA1-352 had a relatively high number of rings (80) so we compared this series against the series already crossmatched, using 40-yr segments lagged 10 years. All 5 segments tested showed the strongest correlations at the +9 position (= beginning ring number of 10) with an average correlation for all five segments of 0.46. The interseries correlation of oak series HA1-352 with the other pine series crossmatched so far was 0.40 ($n = 80$ years, $t = 3.90$, $p < 0.0001$). However, despite the convincing statistical match and convincing crossmatching shown on the skeleton plot, we have no evidence that pines and oaks should crossmatch against each other regionally in eastern Tennessee. At this point, the oak sample must remain floating until a suitable oak chronology of appropriate length is developed, or until crossmatching is confirmed between oaks and pines.

Pine sample RH41S12A had few rings (24) but because the RH41S12 samples came from the same structure, it is probable that the RH41S12 samples are contemporary and should overlap. A convincing crossmatch for the 24-yr overlap was found with a correlation of 0.58 ($t = 3.34$, $p < 0.002$), whereas the two next best positions suggested by COFECHA ($r = 0.44$, $t = 2.30$, $p < 0.02$; and, $r = 0.42$, $t = 2.17$, $p < 0.03$) were less convincing statistically and graphically. Despite this statistical and graphical match, the number of rings in pine sample RH41S12A was too few for conclusive crossmatching.

Sample RE12-DS17, an eastern red cedar sample from the DeArmond site that contained 116 rings, unfortunately could not be confidently crossmatched against the other series, despite some promising temporal placements. Pine sample BY13-F36A from the Ledford Island site had 43 clear rings, but we could not find a convincing match graphically or statistically against the other crossmatched series. We attempted to crossmatch oak sample HA1-44 (representing 30 rings) against the other dated oak sample, HA1-352, and found a fairly strong match ($r = 0.64$, $t = 4.41$, $p < 0.0001$). This position was much stronger than the second highest position at relative ring position 29 ($r = 0.49$, $t = 2.97$, $p < 0.003$). Still, the small number of rings does not allow us to state unequivocally that this sample was crossmatched. All the remaining samples, although measured and analyzed, had too few rings (range of 15 to 24) for conclusive crossmatching.

At this point, we had what we believed were three series crossmatched against each other representing two or three trees. Testing 40-year segments lagged 20 years, no segments of the 12 tested were flagged by COFECHA. These three series had an average interseries correlation of 0.74, and the average mean sensitivity (0.26) suggests reasonable variability in ring patterns, which can facilitate crossmatching among series. The final composite standard chronology (Figure 3) further shows considerable year-to-year variability in ring patterns, suggesting this chronology (and therefore the structures and/or sites represented) can eventually be anchored absolutely in time when a long reference chronology is developed for the eastern Tennessee region.

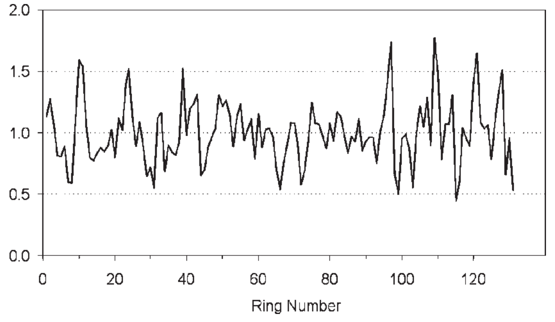

Figure 3. The final 131-year long chronology developed from the three series that were crossmatched in this study.

DISCUSSION

This study investigated 16 archaeologically-recovered wood specimens in a dendrochronological analysis of the temporal placement of Mississippian period sites in East Tennessee. We were able to crossmatch only three of the samples representing two or three trees, from two archaeological sites, the Upper Hampton site in Rhea County along with the sample of uncertain site provenience from the Watts Bar Reservoir in Roane County. Although not absolutely crossdated, these samples demonstrate that tree rings in wood samples taken from archaeological contexts in the Southeastern U.S. can be crossmatched relative to each other.

The samples that remain unmatched were too short (15 to 43 years) for conclusive crossmatching, either graphically or statistically. Often, COFECHA would suggest a logical temporal placement with a high correlation coefficient, but this r-value differed little from the 2nd and 3rd best r-values at alternate placements. In general, the temporal placements suggested by COFECHA must be systematic (most or all segments with the same suggested placement) and robust (r-values that are much higher than the other r-values obtained for alternate placements) (Grissino-Mayer 2001). If these two conditions are not met, then statistical crossmatching can not be verified, despite convincing graphical evidence. The one short sample we believe may be crossmatched (RH41-S12A) could be a fragment of wood represented by the two other samples excavated from this one structure.

One problem when using tree-ring samples to date the construction periods for archaeological sites in the Southeastern U.S. is the absence of bark and outermost rings on the wood samples caused by the rapid rates of decay in the humid

Southeast. None of our samples had sapwood so it is impossible to determine how many rings are missing on the outer part from each sample. This condition precludes determining precise year(s) of construction. Site taphonomic processes may remove a significant portion of the wood once buried for contemporary use (*e.g.* in a post hole for a palisade) and cannot be avoided.

A key problem that faces archaeologists working on Southeastern Mississippian sites is the lack of a protocol for preserving wood samples for tree-ring analysis once they are uncovered. Samples are currently unearthed and wrapped in foil before taken back to the laboratory. The removal of confining soil causes some degraded samples to quickly expand and fragment, including those samples with some charcoal included. Furthermore, some samples are often chemically reduced where the buried wood takes on the physical properties of the surrounding soil (high moisture content and the red to brown color of the dominant Ultisols soils), suggesting that *in situ* preservation with polyethylene glycol (PEG) (Seborg and Inverarity 1962; Stark 1976) prior to ground extraction would be beneficial. Samples of wood that are intact and available for tree-ring analyses at Southeastern archaeological sites are rare, and steps should be taken to ensure permanent preservation of any wood samples found.

Dendrochronologists in the Southeast have had the greatest success in crossdating oak and pine tree-ring series, but eastern red cedar likely provides the greatest potential for development of a 1000-year long chronology for the interior portion of the Southeastern U.S. (millennium-length bald cypress chronologies currently exist in peripheral wetlands and coastal locations). Edward R. Cook, Paul J. Krusic, and others of the Tree-Ring Laboratory of the Lamont-Doherty Earth Observatory at Columbia University have already developed an eastern red cedar chronology for central/eastern Tennessee back to AD 1378 using living trees and samples collected by Florence Hawley and her colleagues in the TVA back in the 1930s. Recent efforts focus on extending this chronology further back using eastern red cedar samples from archaeological sites in the Southeastern U.S.

Our study on the dendrochronological potential of prehistoric archaeological specimens has brought to light many challenges. These include: (1) the limited number of wood samples retrieved to date structures or features within sites, (2) an unknown amount of outer ring loss caused by decomposition of the wood in the ground, (3) the lack of an established protocol for preserving wood specimens for tree-ring analyses, and (4) the lack of an established master tree-ring chronology to anchor archaeological specimens to calendar dates. The positive aspects of this study include: (1) a tentative placement of structures at two sites into relative chronological order, and (2) the establishment of a 131-year long tree-ring sequence for pine in eastern Tennessee, which may be anchored to calendar years with recovery and analysis of additional samples. Future research in prehistoric archaeology in the Southeast, and more specifically eastern Tennessee, needs to include collecting wood specimens from sites for the purpose of dendrochronological dating. This practice had been standard nearly 70 years ago but has since been forgotten. Dendrochronology potentially offers the most precise method of absolutely dating prehistoric settlements and should be a major focus of archaeology in the Southeast. As this study has shown, the use of samples collected long ago in archaeological excavations can still provide some answers to current questions in archaeology.

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