Dugout Canoe
in the
Collections
of the
Bergen County Historical Society

The dugout canoe was one of the very first artifacts donated to the Bergen County Historical Society, shortly after its founding in 1902.

Its age and history has remained something of a mystery and we have long looked to see if available technologies could provide more information.

A Facebook post led to contact with archaeologist R. Alan Mounier who very kindly met with the BCHS Museum Collection Committee on August 29, 2020. He donated his time and knowledge and created the following report. The study greatly expands what we know about the canoe.

At the August meeting, BCHS President Carol Restivo joined the committee which included Patty Daurizio, Michael Ginch and myself. Joe Arsenault also accompanied Mounier to contribute to the investigation.

Response to a Facebook appeal paid for the radio-carbon testing analysis by Beta Analytic, Inc. Many thanks to all those who contributed to moving this project forward!

Deborah Powell
BCHS Past President
Museum Collection Chair
BergenCountyHistory.org

November 2020

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The Ackerson Canoe: Radiocarbon Dating and Wood Identification
Report to the Bergen County Historical Society
River Edge, New Jersey

by
R. Alan Mounier

October 16, 2020

Introduction

This article presents new information concerning the age and type of wood comprising the Ackerson canoe, which is a log boat or dugout canoe that was reportedly discovered in 1868 in Hackensack on land belonging to Colonel Garret G. Ackerson. His heirs donated the craft to the Bergen County Historical Society in 1904. Since its form and the tool marks from its construction provide scant clues to its origin, the age of the canoe has always been a matter of conjecture. Radiocarbon dating demonstrates that the canoe is the product of the historic era, most likely dating between ca. AD 1650 and AD 1815. The identity of its makers remains unknown. Microscopic examination of wood reveals the parent wood as American chestnut (*Castanea dentata*), thus, amending a historical misidentification as white oak (*Quercus alba*). This article describes the analytical techniques involved in the present study along with relevant background information.

Joseph R. Arsenault and I examined the canoe and took samples on August 29, 2020 at the Steuben House, River Edge, N.J. Mr. Arsenault is a senior ecologist and archaeologist, as well as an esteemed research associate. Representing the Bergen County Historical Society were Deborah Powell, Michael Ginch, and Carol Restivo. I am indebted to each for valuable information and for help rendered during the sampling process. Particular thanks go to Ms. Powell for providing archival materials relating to the history of the canoe, and for organizing the sampling event. Judith J. Sullivan kindly provided references to other dugout canoes found elsewhere in the region.

Background Information

Log boats have been made around the world wherever forests supply trees of suitable size. The fundamental design is practically universal: a section of trunk is flattened and hollowed out to create a hull. Our information about Native American canoes comes from a handful of early historical accounts, chiefly by John Smith in Virginia, William Wood in New England, and Samuel de Champlain in New France (Plane 1991:10). Secondary accounts recite species identity on the strength of previous testimony with no attempt at authentication. Various references indicate that sycamore, cedar, chestnut, and pine were used by indigenous peoples here and elsewhere along the Atlantic seaboard (Heston 1924; Monthly Evening Sky Map 1924; Newcomb 1956:29; Plane 1991; Wheeler et al. 2003; Mounier 2003:113). Although the

Linnaean names are rarely cited, one may suppose that sycamore refers to *Platanus occidentalis*; cedar to white cedar or *Chamaecyparis thyoides*; and, chestnut to *Castanea dentata*. Among pines represented in canoe inventories are white pine (*Pinus strobus*) and yellow pines (e.g., *Pinus echinata*, but generally not listed by species). In areas where it occurs, cypress (*Taxodium distichum*) has been identified in prehistoric canoes (Wheeler et al. 2003: 542). Among the Lenape or Delaware Indians, the favored tree for dugout canoes was the tulip tree or yellow poplar (*Liriodendron tulipifera*). Indeed, the Native word for this poplar translates as "the canoe-making tree" (Mahr 1954:382).

There has been some confusion about the wood from which the Ackerson canoe was fashioned. According to the current display plaque, "The United States Forestry Department has identified the wood as white oak." However, documentation supporting that identification appears to be lacking. A newspaper account dating to 1904 asserts, without verification, that the canoe was made of chestnut (Passaic Daily News 1904). Since it is likely that any suitably sized tree could be fashioned into a hollowed log boat, a detailed microscopic analysis of wood samples was necessary to make an accurate determination. As shown in greater detail below our analysis demonstrates that the boat indeed consists of chestnut.

The creation of dugout canoes by selective burning and scraping was well known among the Indians of the eastern forests, which yielded large trees appropriate to such production (Wood 1989; Wissler 1938:38; Zeisberger 1910:23). Plane (1991:10) quotes William Wood's early 17th century account of canoe making:

> Their Cannows be made...of Pinetrees, which before they were acquainted with English tooles, they burned hollow, scraping them smooth with Clam-shels and Oyster-shels, cutting their out-sides with stone-hatchets (Wood 1898:96).

Europeans also fashioned boats by hollowing out logs, but frequently wood was removed by hewing and gouging with steel tools, thus eliminating or reducing the need of fire in the production process. In hewing, an axe is used to sever the wood fibers across the grain so that pieces could be pried or chipped out at the chop marks or "stop-cuts" with adzes or chisels.

Traditional boat builders often relied upon modified tree trunks as keels and built upwards with boards to create hulls of considerable depth. In some cases multiple logs were joined together to fashion the hull. This procedure was historically employed in building the famous bugeye boats for oyster dredging on the Chesapeake Bay.

Propelled by poles or paddles, dugout canoes permitted travel as well as the transportation of heavy or awkward cargos. While push-poles and paddles are unknown from archaeological contexts in New Jersey, Harrington (1924:258) reported the discovery in 1880 of a deteriorated oak paddle from Canoe Place on eastern Long Island. In historic times, dugout canoes were often outfitted with masts and sails.

History of the Ackerson Canoe

History records that the canoe was discovered in or about 1868 along the Hackensack River on the estate of Colonel Garret G. Ackerson (McMahon 1992). Note that a newspaper article from 1904 dates the discovery to 1858 (Bergen Evening Record 1904). Early accounts indicate that the canoe contained a halberd or other articles, but these reports must be greeted with some skepticism for want of contemporaneous documentation or surviving artifacts. A persistent anecdote relates that the canoe was used for a time as a livestock trough, being fastened to a supporting structure with iron nails, remnants of which still pierce the sides beneath the gunwales.

Because of its dugout form, claims have been advanced concerning the canoe's origin in prehistoric times or at least at the hands of Native artisans. Very crisp tool marks strongly suggest that the implements used to hollow out the log (or to finish it) were made of sharp steel, in consequence of which an origin in the historic period has been conjectured.

Description of the Canoe

The canoe is a long, narrow boat, fashioned by hollowing a length of tree trunk. The hollowing cuts reveal the radial core of the log, approximately at mid-depth in the hull. The wood is remarkably well preserved. The craft is symmetrical, terminating in gently rounded, somewhat pointed shapes at either end. When viewed from the side both ends sweep downward from the gunwales towards the bottom, forming distinct arcs; thus, making the bow and stern functionally equivalent. With no distinct keel, the bottom of the hull is rounded, presumably following the natural contour of the parent log.

The upper surfaces of both ends display shallow rabbets, cut to receive horizontal boards known as breasthooks, each of which served to strengthen the gunwales, to provide a small deck, as well as a convenient handhold when launching or landing the canoe. In addition, the chamber created beneath these boards might have accommodated a small amount of stowage.

The breasthooks were removed at a time and under circumstances now unknown. However, we have a photograph showing their presence (Figure 1). More or less vertical holes in the gunwales suggest fastening by means of nails. Indeed, a vertically aligned nail still remains in one end of the boat.

As reported by McMahon (1992) nails pierce the sides of the craft at various points beneath the gunwales (Figure 2). The surviving fasteners are cut nails, so-called because of manufacture from sheared blanks of flattened iron bars. Such nails originated in the late 18th century but were not in common use until around the third decade of the 19th century (Nelson 1968; Wells 1998). Prior to the introduction of this technology, nails were made at the blacksmith's forge by hammering narrow strips of wrought iron to produce tapered shanks and flattened heads. The presence of cut nails would be consistent with the manufacture of, or modifications to, the canoe during or after the first decade of the 19th century. While already attributed to the use of the canoe as an animal trough, the nails may give plausible evidence of blocks mounted to support oarlocks, thole pins, or thwarts.

Dimensions

The dimensions of the canoe, recorded at the time of our inspection, were as follows:

Length: 4.55 meters (14' 11-1/8")

Width at Top-Center (Gunwale to Gunwale): 0.48 meters (1' 6-7/8")

Depth at Center (Gunwales to Floor): 0.23 meters (0' 9-1/16")

Height from Bottom to Gunwales: Not measured.

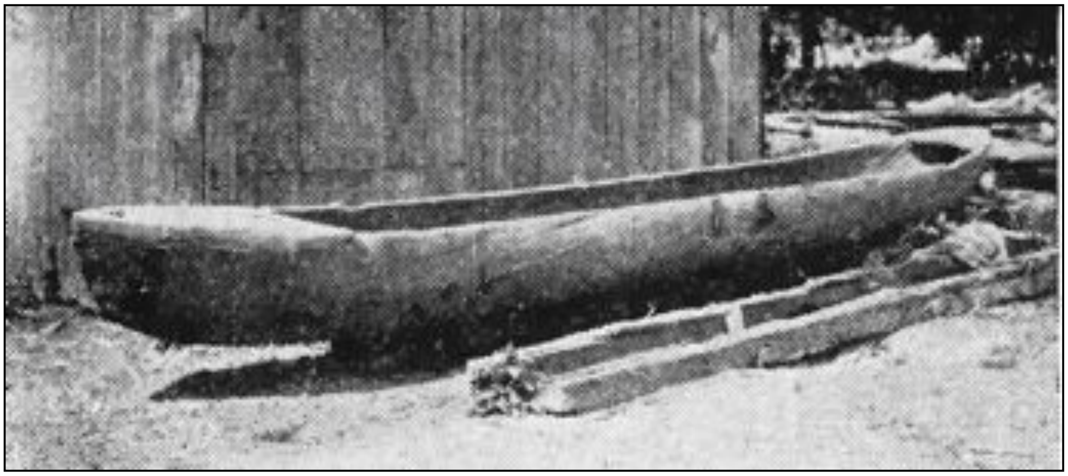

Figure 1: Undated Photograph of Canoe, Showing Breasthooks

Source: Unknown. Photograph courtesy of Deborah Powell.

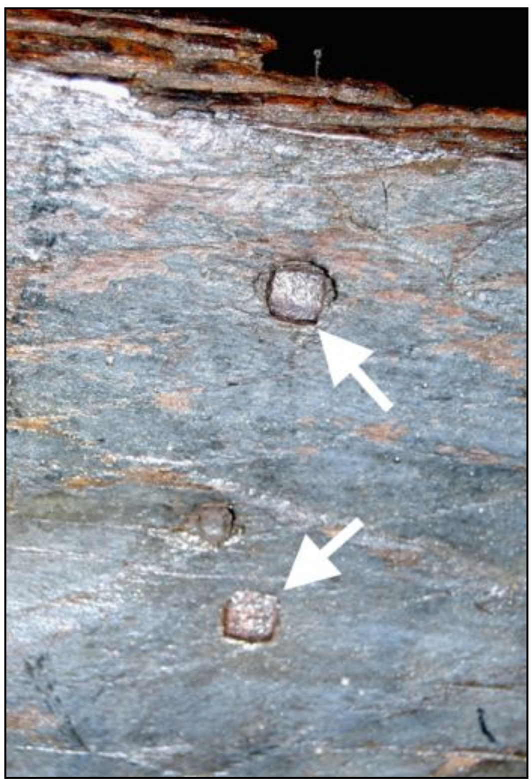

Figure 2: Detail View of Cut Nails in Gunwale

Arrows indicate nail heads.

Photograph courtesy of Joseph R. Arsenault.

The color of the wood varies from reddish brown to grayish brown depending upon location and past treatment. In places the wood lacks luster and has a rather coarse texture. Elsewhere it gleams and has a waxy look as well as a smooth feel. Preservative coatings doubtless affect the perception of color and texture. McMahon (1992) mentions traces of blue-gray paint as well as a glossy, transparent finish that he says was applied in 1937. On surfaces freshly exposed by our sampling, the color is reddish yellow, in the Munsell color range of 7.5YR 6/6–7/6.

Analytic Sampling

Samples were removed from the canoe to provide information on its age and to identify the wood from which it had been made. In concert with museum staff, we discussed various possibilities for sampling to obtain adequate specimens that would not unduly modify the appearance or physical integrity of the canoe. We decided to remove a small cylindrical core from the inner surface of one end, as well as a modest, rather cuboidal section of the gunwale at a point where a cut had been made in the past for the attachment of a breasthook (Figure 3).

Figure 3: Wood Samples

Gunwale Sample at Left. Core Sample at Right.

Photograph by R. Alan Mounier

The Core Sample: We placed the sample hole about 80mm (slightly more than three inches) below the gunwale, where the thickness of the wood permitted relatively deep penetration without the risk of boring completely through the wall (Figure 4). We used a 19mm (3/4-inches) diameter hole saw to cut a plug about 15mm (19/32-inches) in diameter and a similar depth into the side of the canoe. We judged that this depth would be sufficient to penetrate the body of the canoe beyond the reach of any chemical preservatives previously applied. This was important to ensure an uncontaminated sample for carbon dating. The saw contained a centrally mounted pilot drill, which left a hole in the core. By placing a close-fitting screwdriver into the pilot hole, and applying lateral pressure, the plug was snapped off and removed from the hole. Next we extracted a sample of shavings or chips from the hole, using a specialized, chisel-edged drill, known as a Forstner bit. These shavings comprised the sample sent for age determination. To minimize the possibility of introducing contaminants into the sample, we chose a bit that was slightly smaller in diameter than the preliminary hole.

As the bit penetrated the wood, the shavings were collected on a piece of cardboard and immediately transferred to a scale for weighing. The empty hole was plugged with a pine (*Pinus sp*.) dowel trimmed for a snug fit. The dowel was inserted into the hole and then cut off slightly above the surface to permit easy removal if desired. The dowel contrasts in color and composition with the canoe, thus making obvious the point of sample extraction (Figure 5).

The dimensions of the core are as follows:

Outer Diameter: 15mm (19/32-inches).

Inner Diameter: 6.35mm (1/4-inches);

Length: 15mm (19/32-inches);

Weight of Core: 1.0g.

Weight of Shavings: 0.8g.

The Gunwale Sample: A small piece of one gunwale was removed with a small, fine-tooth saw to provide a sample for wood identification and to supply a potential supplementary sample for carbon dating if needed. The sample followed the lines of an existing cut made at an indeterminate time to accommodate a breasthook (Figure 6).

At one end the material originally removed to receive the breasthook left a more or less rectangular shoulder. A short section of this shoulder was undercut horizontally at the level of the original rabbet, and then removed by a vertical cut.

The dimensions of the sample thus removed are as follows:

Length: 18mm (<3/4-inches)

Height: 23mm (29/32-inches)

Weight: 2.7g.

The Question of Age

Dugout canoes have great antiquity, but also surprisingly great modernity. Wheeler et al. (2003) report on dugout canoes from Florida dating back as many as 7000 years ago. The discovery of woodworking tools—and gouges in particular—provides inferential evidence for hollow-work, such as dugout canoes in archaeological contexts (Ritchie 1932). On the other hand, Plane (1991) has shown that the majority of log boats in her New England study date to the historic period, with examples noted in service in remote areas well into the 20th century. In general the extent and quality of wood preservation varies inversely with age. On this basis a well-preserved specimen such as the Ackerson canoe is likely to reflect relatively recent manufacture.

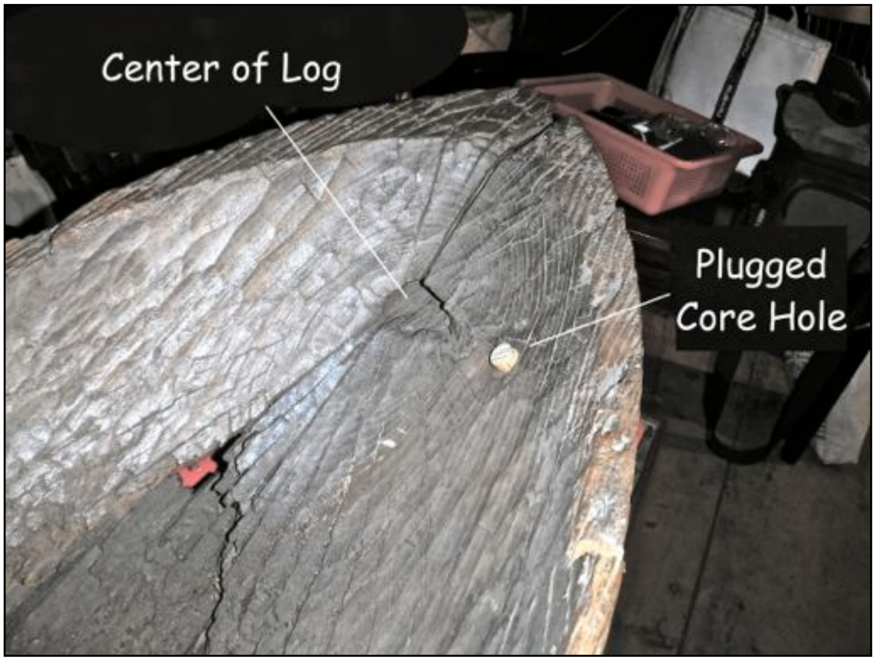

Figure 4: Location of Core Sample

Note manufacturing tool marks. Photograph by R. Alan Mounier

Figure 5: Detail of Core Sample Location and Plug

Note manufacturing tool marks. Photograph by R. Alan Mounier

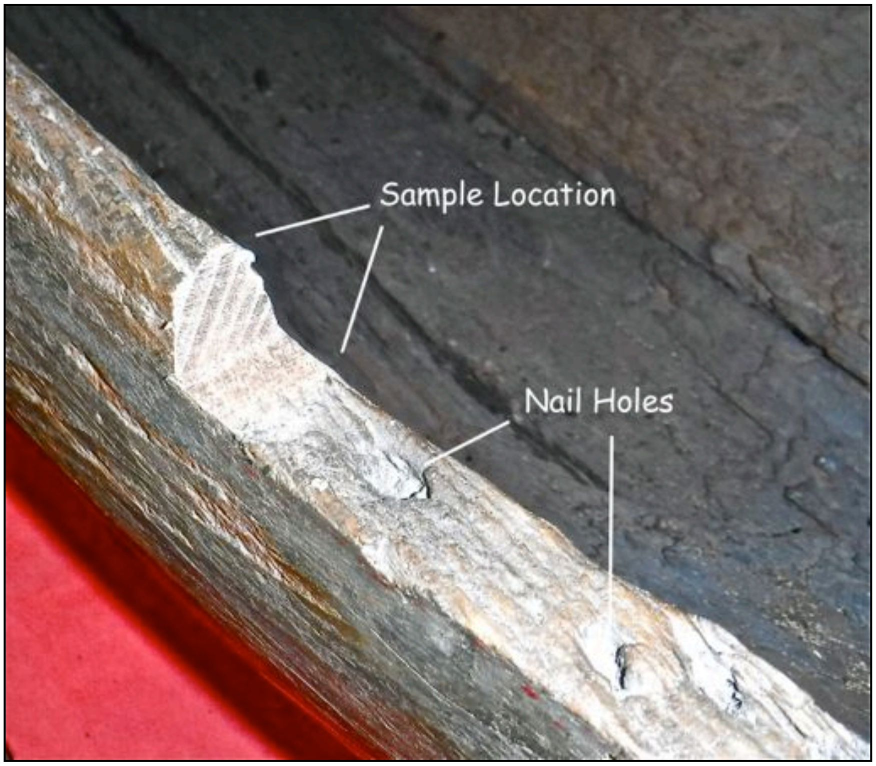

Figure 6: Location of Gunwale Sample

Annual growth rings are visible on the vertical cut.

Nail holes evince a now missing breasthook.

Photograph by R. Alan Mounier

From the earliest published notices, the age and cultural affiliation of the Ackerson canoe has been in question. The headline on a news account, reporting the donation of the canoe to the Bergen County Historical Society, reads, "Old Indian Canoe Found In Hackensack." However, the same article questions its origin: "It is impossible to say to what period this canoe belongs, if it is an Indian work at all, unless something more distinctive than a wooden canoe can be found" (*Passaic Daily News* 1904).

When, in 1924, two dugout canoes of cedar were dredged from Witteck Lake, near Butler, N.J., it was claimed that they were "typical of two Ramapo Indian dugouts, one of which was on exhibition … at Hackensack" (*The Monthly Evening Sky Map* 1924*).* This notice apparently alludes to the Ackerson canoe, and speculates about its manufacture by the Ramapo Indians, an enclave of Native descendants residing in the Ramapo Mountains in nearby parts of Bergen and Passaic Counties.

A column in the *Bergen Evening Record* (1904) observes that, when the Ackerson canoe was found, "No one doubted that it was an Indian canoe." But the writer goes on to say:

> Whether it is an Indian canoe or was made by someone later cannot be determined now… White men used to build canoes and dugouts, for this is simply a dugout… The adz marks show a sharper instrument than the old Indians were in the habit of using; the lines are

> much better than Indians make; across each end were boards. These things show a higher grade of skill than an Indian possessed.

While the last assertion may be challenged, the manner of construction does indeed suggest the likelihood that the canoe dates to the historic period.

Nevertheless, appearances can be deceiving. Distinct tool marks by themselves define neither temporal range nor tool composition. Working on a prehistoric site in northern Newfoundland in 1968, I saw distinct adze scars on the face of a whalebone plank, hewn with stone or walrus ivory implements. Those ancient adze marks were very crisp notwithstanding an age of three to four thousand years as determined by radiocarbon dating (Tuck 1971). However, such occurrences are exceedingly rare. The most parsimonious interpretation of the tooling in evidence on the Ackerson canoe is that sharp steel tools were used in its creation. Also suggestive of origin in the historic era are the remarkable state of preservation and the incorporation of secondary features; namely, breasthooks. The perception of relative modernity is supported independently and quite convincingly by the results of radiometric dating, as detailed below.

Radiocarbon Dating

All living tissues incorporate naturally occurring radiation from the environment in the form of radioactive carbon. The radioactive isotope of carbon is ^{14}C, while the non-radioactive isotopes are ^{12}C and ^{13}C. Incorporated radioactivity remains in equilibrium with environmental radiation until death occurs. From that point onward the radioactivity decays at a known rate, thus enabling the calculation of age of deceased organic samples, based on the ratio of radioactive to non-radioactive carbon. It is important to understand that the technique dates the organic material rather than its cultural use. Accordingly, the age of the canoe must postdate the demise of the tree, but it can be reasonably supposed that the canoe was made soon after the log became available for use. Ethnohistorical accounts suggest that the boat may have been fashioned from a tree intentionally felled for that purpose.

The Beta Analytic laboratory in Miami, Florida performed radiocarbon testing on the wood removed from the canoe (Beta - 567618). The laboratory employed Accelerator Mass Spectrometry (AMS) to determine the probable age of the sample. This technique allows direct counting of radiocarbon atoms under highly advanced and precise laboratory conditions.

The report places the conventional radiocarbon age of the wood at 180 +/- 30 BP (years before present). That value represents 180 years before the conventionally recognized “radiocarbon present” of AD 1950, with an error factor of plus or minus 30 years. That result would date the sample roughly to AD 1770 +/- 30, or between AD 1740 and AD 1800. However, “radiocarbon years” do not correspond directly to calendar years. Calendrical calibration, based on tree-ring data, is undertaken to correct this discrepancy. The actual calibrated dates can be stated with a 94.5% probability as having certain chances of occurring within stipulated date ranges, as follows (Table 1).

There is a 19.7% chance that the actual date falls between AD 1652 and AD 1696, and a 53.4% chance that it falls between AD 1725 and AD 1814. There is a chance (17.9%) that the date lies between AD 1836 and AD 1877. This range extends beyond the historically reported date of discovery (AD 1868) by nine years. The analysis also indicated a 4.5% chance of an occurrence after AD 1916, but this interpretation can be discounted as historically impossible, since the Society came into possession of the canoe before 1916.

Table 1: Radiocarbon Age Determination (Beta-567618)	
Assessed Radiocarbon Age: 180 +/-30 BP	
Calendrical Calibrations	
Date Range	**Chance**
AD 1652 – AD 1696	19.7%
AD 1725 – AD 1814	53.4%
AD 1836 – AD 1877	17.9%
AD 1916 or later	4.5%

The log from which the canoe was cut possesses rather clear annual rings. This situation holds forth the enticing possibility of very accurate dating by means of dendrochronology if the ring pattern could be matched to a regional sequence (Alex Wiedenhoeft, pers. comm., 9/26/20). This research is beyond the scope of the present project.

<u>Wood Identification Analysis</u>

Because woody plants have certain characteristic anatomical structures, close examination often enables identification of a wood sample to genus and sometimes even to species. The principal structures useful in wood identification include the tubular elements that run vertically within the stem or trunk and those that radiate from the pith to the bark. The vertical structures are tracheids and vessel elements, sometimes simply called pores, whose patterns of growth over time produce the familiar rings that we use to determine a tree's age. The horizontal elements are called medullary or pith rays, or simply, rays, because they radiate from the tree's core, rather like the spokes of a wheel. Other structures such as parenchyma and fibers, which can occur in both axial and radial planes, perform various functions. All of these elements form complex interwoven matrices that serve the tree's vital functions while providing physical rigidity and mechanical strength. Each kind of tree produces some or all of these elements in combinations that are distinctive; hence, useful for identification. Still, closely related species may share traits that thwart identification closer than the genus level.

Trees are regarded as belonging to one of two general categories; namely softwoods or hardwoods. The softwoods include gymnosperms, i.e., needle-leaved conifers; while the hardwoods are angiosperms, i.e., flowering deciduous trees. In a physical sense the categorical distinction between softwoods and hardwoods is somewhat inaccurate, inasmuch as some softwoods are harder than some hardwoods. For example, pitch pine (*Pinus rigida*), a softwood, is denser and more resistant to cutting or denting than basswood (*Tilia Americana*), nominally a hardwood.

In attempting to identify a wood sample one typically tries to categorize the specimen as to general type (i.e., softwood vs. hardwood) and to narrow down the possible outcomes by examining discrete features and constellations of traits. Much of this analysis requires making clean cuts along three critical alignments, those being the transverse (X), radial (R), and tangential planes (T), as shown in Figure 7.

The transverse plane, or cross-section, cuts the trunk, or a portion of it, at right angles to its long axis. This is the plane most commonly used in felling a tree. It reveals seasonal growth patterns resulting in annual rings. In the early period of growth the pores tend to be large, forming what is termed “earlywood.” In the late season growth, they become smaller or even indistinct. This later phase of growth constitutes the “latewood.” Together, the two comprise an annual ring.

The radial plane originates at the tree’s core and terminates at the inner bark edge, at right angles to the transverse section. The rays may be very small, both short and narrow, or they may be very robust, depending on species characteristics.

The tangential plane lies perpendicular to the radial plane and tangent to the growth rings. This plane provides a cross-sectional cut through the axial elements, that is, the vessels and related tissues, as well as the rays. In this view the vessels appear as a series of bundled tubes, whereas the rays appear as tapering, lenticular figures.

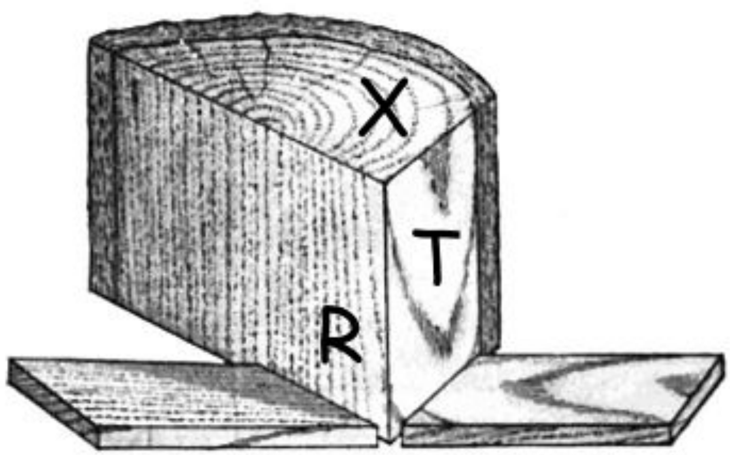

Figure 7: Planes for Wood Identification

(After Snow 1903, Fig. 3)

— KEY —

X – Cross Section (Transverse Plane); R – Radial Plane; T – Tangential Plane

Clean cuts along each of these planes with very sharp instruments—razors, knives, or chisels—can reveal, under magnification, all of the structural details needed to make successful identifications of wood in good condition. However, exposure to extremes of heat, humidity, physical forces, or attack by molds or insects can modify the structure of wood and complicate or thwart identification protocols. Heavily modified wood may require chemical or mechanical stabilization, while very small samples may call for special facilities for holding and preparing specimens for examination.

We examined both the core and the gunwale specimens at various powers of magnification using hand lenses of 10x and 20x, as well as a stereo binocular microscope (Amscope Model SM-2T) at powers ranging from 14x to 135x. The use of a microscope-mounted digital camera (Amscope MU130) permitted microphotography in the range of magnifications just noted.

Microscopic examination of wood samples conclusively demonstrates the parent wood as American chestnut (*Castanea dentata*). This finding accords well with a newspaper account from 1904, which identifies the wood as chestnut (Passaic Daily News 1904). Accounts that identify the wood as white oak (*Quercus alba*) are incorrect.

The samples extracted from the canoe present cell structures consistent with that of American chestnut, including large, oval pores in the earlywood, trailing off to smaller, more or less radial latewood pores, and very fine medullary rays. The rays in chestnut are uniseriate (only one cell wide) and are visually indistinct even under magnification (Figure 8). This feature sets chestnut apart from all of the oaks, which have very prominent rays (Figure 9). My analysis was confirmed by Dr. Alex C. Wiedenhoeft, of the Center for Wood Anatomy Research with the U.S. Forest Service in Madison, Wisconsin (Wiedenhoeft, pers. comm. September 25, 2020).

Figure 8: Transverse Section of Canoe Showing Typical Structure of Chestnut (21x)

Note pore structure and the absence of conspicuous medullary rays.

Photograph by R. Alan Mounier

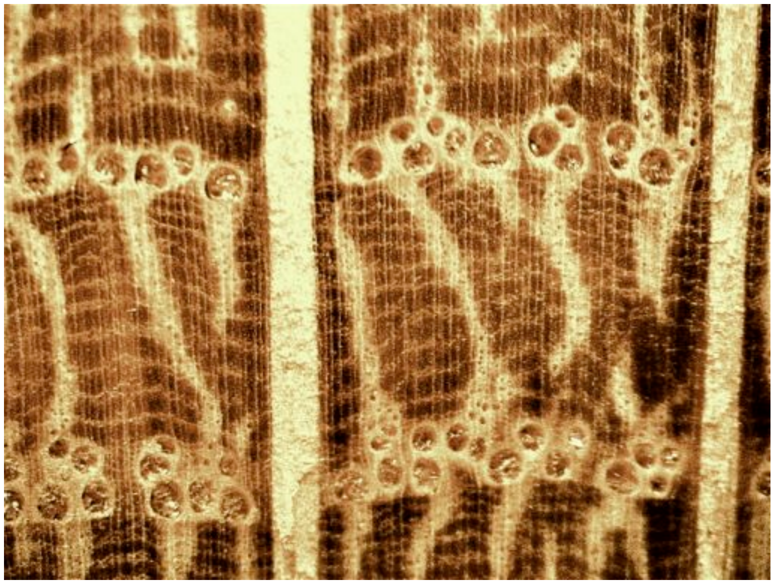

Figure 9: Typical Transverse Section of White Oak (20x)

Note the pore structure and the presence of prominent rays (broad vertical bands).

Photograph by R. Alan Mounier

Summary

The physical condition and construction details of the canoe suggest that it is a product of the historic era, including a time when at least some of the Native peoples were still present among the European colonists. A radiocarbon assay bolsters this interpretation, with the most likely date falling between AD 1652 and AD 1814. Microscopic examination of wood samples demonstrates that the canoe was made from American chestnut, previous claims to the contrary notwithstanding. Because of technological similarities in the manufacture of dugout watercraft across time and space, there is insufficient evidence to attribute the manufacture of the Ackerson canoe to a particular group of people, whether autochthonous or otherwise. Early but persistent reports of associated exotic artifacts or other articles should be treated as apocryphal until such time as their validity can be substantiated.

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