Archeobotanical Analysis of Archived Soil from the James Fort Period Well

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A single soil sample collected from ER 2158 Layer Z within Stratum 177 of the James Fort well (ca. 1611-1617) was submitted for macro-botanical analysis based on its potential to contain tobacco seeds. Archeobotanical analysis of related contexts was accomplished by Steven N. Archer in 2006. Archer's research provided the first systematic study of macro-floral remains preserved within the well, and documented the presence of tobacco *(Nicotiana sp.)*. Archer conclusively identified one tobacco seed, and tentatively identified three others. These specimens represented a unique find, heretofore being the only archaeological tobacco seeds recovered from the period of the colonial encounter. There are myriad challenges to the recovery of archaeological tobacco seeds: They are extremely small, and the manner of tobacco cultivation includes topping the flowers of the growing plant to enhance leaf growth, necessarily preventing the propagation of seed. The current research effort was motivated by a desire to recover additional tobacco seeds from the well which could be used for destructive analysis (i.e. DNA testing) to determine more specific details about the kind of tobacco utilized and produced at the site during the James Fort period.

Methods

A single 975ml soil sample (JR2158Z, STR 177) collected in 2006 and archived under refrigeration was submitted to the archeobotanical laboratory of Justine McKnight in Severna Park, Maryland for processing and macro-floral analysis. The sample was completely waterlogged, with vegetable material and charcoal flecks visible in a matrix of wet soil. Archeobotanical materials were separated from sample sediment using a gentle water-screening technique through nested geological sieves following standard procedures (Pearsall 2001:83-84; Kenward et al. 1980:8-11) and used with success by Archer in his 2006 study. Sieve apertures measured 4mm, 2mm, 1mm, 500µ, and 250µ. Material measuring less than 250µ in diameter was discarded. The sample was processed in small batches, approximately 25ml at a time, in order to minimize abrasion of delicate plant artifacts. The 500µ and 250µ fractions were predominantly composed of coarse sand. To facilitate the recovery of small seeds, these fractions were subjected to additional processing: Each was placed in a conical sedimentation flask and gently swirled to produce a mild centrifuge action. Organic material separated from the sandy matrix and was poured onto a series of filter papers for review beneath the microscope. The residual sandy matrices were also scanned under magnification for the remains of seeds and cultivated plant parts. All sample components were kept moist during analysis, and all materials (both archeobotanical and residual) were packaged in deionized water for storage.

All archeobotanical remains encountered within the >4mm size fraction were isolated for

identification. Nutshells, seeds, cultivated plant remains and miscellaneous plant materials were removed from the >2mm/<4mm size fraction. Seeds, cultivated plant remains, and identifiable botanical miscellany were isolated from the >1mm/<2mm, >500µ/<1mm, and >250µ/<500µ fractions.

Identifications were routinely attempted on all seed, nut and miscellaneous plant remains, and on a sub-sample of 10 randomly selected wood charcoal fragments and 10 randomly selected non-carbonized wood fragments (>4mm in size) in accordance with standard practice (Pearsall 2000). Identifications of all classes of botanical remains were made to the genus level when possible, to the family level when limited diagnostic information was available, and to the species level only when the assignment could be made with absolute certainty. Tentative identifications are preceded by "cf" ("compares favorably" with). All identifications were made under low magnification (10X to 40X) with the aid of standard texts (Edlin 1969; Kozlowski 1972; Hoadley 1990; Martin and Barkely 1961; Panshin and deZeeuw 1980; Schopmeyer 1974) and checked against plant specimens from a modern reference collection representative of the flora of James City County, Virginia.

Results

Organic preservation within the JR2158Z, STR 177 sample was excellent, with a great variety of carbonized (burned) and uncarbonized plant remains recovered through the waterscreening process. The residual fraction matrices contained a range of artifacts and ecofacts, which are generally described in Table 01. Wood remains are noted, where present, in the size fractions from which they were not isolated for identification.

Table 01: Materials observed within the fraction matrices. Sample JR2158Z, STR 177.

sample number	JR2158Z
sample description	well fill, pollen sample
collection/processing date	4/19/2006, 5/9/2011
volume (ml)	975
>4mm	Quartzitic gravel, brick fragments, oystershell, bone fragments, glazed redware
>2mm/<4mm	gravel, brick fragments, deciduous leaf fragments, wood fragments, eggshells, fish scales, bone, amber glass
>1mm/<2mm	coarse sand, brick fragments, bone, deciduous leaf fragments, wood fragments, eggshells, fish scales
>500µ/<1mm	sand, gastropods, insect parts, insect eggs, brick fragments, deciduous leaf fragments, wood fragments, spherical carbon residue
>250µ/<500µ	sand, insect parts, insect eggs, wood fragments, spherical carbon residue

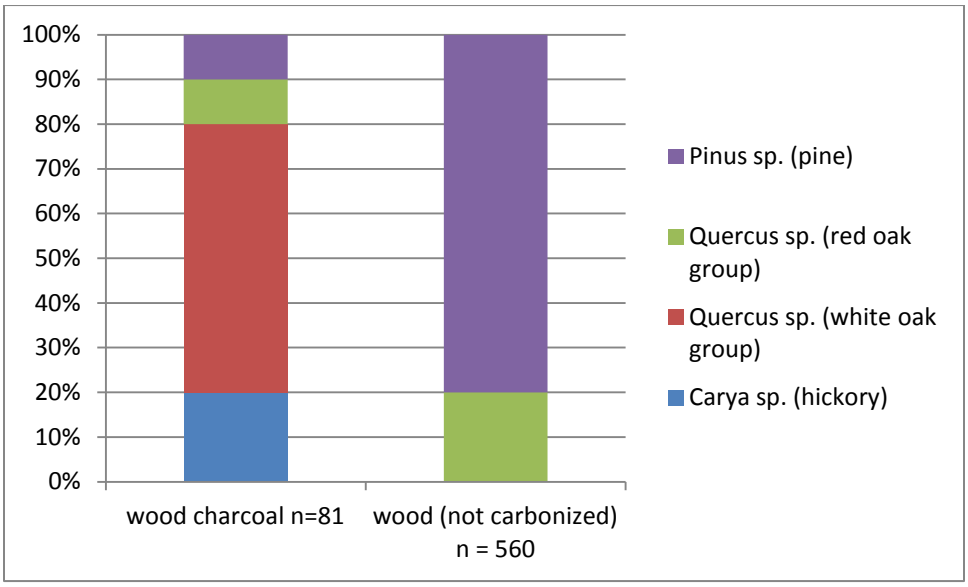
Table 02: Inventory of archeobotanical remains recovered from Sample JR2158Z, STR 177.

sample number	JR2158Z from STR 177
sample description	well fill, pollen sample
collection date, processing date	4/19/2006, 5/9/2011
volume (ml)	975
WOOD (charcoal) (no of fragments > 4mm)	81
Carya sp. (hickory)	2
Quercus sp. (white oak group)	6
Quercus sp. (red oak group)	1
Pinus sp. (pine)	1
total identified fragments	10
WOOD (not carbonized) (no of fragments >4mm)	560
Quercus sp. (red oak group)	2
Pinus sp. (pine)	8
total identified fragments	10
NUTSHELL (not carbonized) (no of fragments > 2mm)	37
Carya sp. (hickory)	35
JUGLANDACEAE (walnut family)	2
SEEDS (not carbonized) (no of specimens)	40
Amaranthus sp. (pigweed)	1
Cucurbita sp. (squash) seed fragment	5
cf. Fragaria sp. (strawberry)	1
Liriodendron tulipifera (yellow poplar) basal fragment of achene	1
Mollugo verticillata (carpetweed)	2
Nicotiana sp. (tobacco)	**4**
Panicum/Setaria (panic/foxtail grass)	1
Phytolacca americana (poke)	1
Portulaca oleracea (purselane) seed	1
Rubus sp. (raspberry or blackberry) seed	4
Vaccinium sp. (blueberry)	5
CYPERACEAE (sedge family) three types represented	6
POACEAE (grass family)	5
cf. POLYGONACEAE (knotweed family)	1
UMBELLIFERAE (carrot family)	2
MISCELLANEOUS (not carbonized) (no of specimens)	24
cf. Cucurbita sp. (squash) rind fragments	2
monocot stem fragment	2
fungal fructification	4
bud	2
Quercus sp. (oak) flowers	10
unidentifiable rind/peel	1
amorphous	3

Sample JR2158Z contained a wide array of plant taxa which collectively document a cultural assemblage composed of fuel waste, foodstuff, building debris, seed stock, and weedy vegetation emblematic of an anthropogenic landscape. An inventory of the archeobotanical materials identified within the sample is presented in Table 02. The macro-botanical remains are discussed by general type below.

Wood: Analyzed wood remains were limited to fragments >4mm in diameter. Eighty-one fragments of wood charcoal and 560 fragments of uncarbonized wood were recovered from this largest size fraction. Ten fragments from each wood population were randomly selected for identification. Identification of the random sub-sample of charcoal fragments documented the presence of white oak *(Quercus sp. LEUCOBALNUS group)* (six fragments), hickory *(Carya sp.)* (two fragments), red oak *(Quercus sp. ERYTHROBALANUS group)* (one fragment), and pine *(Pinus sp.)* (one fragment). The woods represented within the charcoal assemblage suggest the intentional selection of locally available, high-calorie woods for fuel. The uncarbonized wood was dominated by pine *(Pinus sp.)* (eight fragments) with red oak *(Quercus sp. ERYTHROBALANUS group)* (2 fragments).

Figure 01: Comparison of carbonized and uncarbonized wood types identified.



Nutshells: Two species of nuts were identified within the JR2158Z sample. Thick-walled hickory *(Carya sp.)* shell fragments totaled 35 specimens. Two fragments of black walnut *(Juglans nigra)* shell were also recovered. All nutshells were uncarbonized.

Seeds: Uncarbonized seeds from the well sample totaled 40 specimens. An array of economically important species are represented, including four excellently preserved tobacco *(Nicotiana sp.)* seeds (see Figure 02). The remains of comestible plants include pigweed *(Amaranthus sp.)* (one seed), squash *(Cucurbita sp.)* (five seed fragments), purselane *(Portulaca oleracea)* (one seed), raspberry or blackberry *(Rubus sp.)* (four seeds), blueberry *(Vaccinium sp.)*

(five seeds), poke *(Phytolacca americana)* (one seed) and perhaps strawberry (cf. *Fragaria sp.*) (one seed). Other species represented include yellow poplar *(Liriodendron tulipifera)* (one fragment from the base of achene), carpetweed *(Mollugo verticillata)* (two seeds), panic or foxtail grass *(Panicum/Setaria)* (one seed), sedge *(CYPERACEAE)* (six seeds conforming to three basic types), grass *(POACEAE)* (five seeds), carrot *(UMBELLIFERAE)* (two seeds) and possibly knotweed (cf. *POLYGONACEAE*) (one seed).

Figure 02: One of the four tobacco seeds *(Nicotiana sp.)* recovered from Sample JR2158Z STR 177. Scale = 1mm grid

Miscellaneous Plant Remains: A variety of miscellaneous floral elements were recovered from the well sample, these include: Two rind fragments were tentatively identified as squash (cf. *Cucurbita sp*.); two fragments of monocot stem; four fragments of fungal fruiting bodies; two buds; ten oak flowers *(Quercus sp.)*; one fragment of unidentifiable rind or peel; and three fragments of amorphous starchy material.

Discussion

The archeobotanical remains recovered from well sample JR2158Z, STR 177 document a rich array of culturally important plant taxa. The assemblage is almost exclusively New World in origin. There is a notable absence of European crop plants within the sample, and the identified plant comestibles confirm a reliance on native cultigens (ie. squash) and wild plant foods (hickory and walnuts, berries) common in the vicinity of James Fort. The species status of carpetweed *(Mollugo verticillata)* and purselane *(Portulaca oleracea)* continues to be debated among botanists. Both have extensive old-world distribution, and have historically been considered exotic weeds here in the Americas. However, there is a growing body of evidence that these plants were naturalized in North America during prehistoric times, and increasingly

archeobotanists consider the precolombian introduction of these species into eastern North America highly probable (Chapman, Stewart and Yarnell 1973).

There is consistency between Archer's 2006 analysis and the current results from JR2158Z, STR177. Table 03 presents an overview of seed taxa identified from the two investigations.

Table 03: Comparison of 2006 and 2011 seed remains recovered from JR2158Z.

	JR2158Z, STR 177	JR 2158Z
	2011 results	2006 results
American holly (Ilex opaca)		x
black walnut (Juglans nigra)	x	
blackberry/raspberry (Rubus sp.)	x	x
blueberry (Vaccinium sp.)	x	x
carpetweed (Mollugo verticillata)	x	
cf. catchfly (Silene sp.)		x
cf. Chickasaw plum (Prunus angustifolia)		x
cf. gum (Nyssa sp.)		x
cf. knotweed (POLYGONACEAE)	x	
cf. strawberry (Fragaria sp.)	x	
grass (POACEAE)	x	
hickory (Carya sp.)	x	
panic/foxtail grass (Panicum/Setaria)	x	
pigweed (Amaranthus sp.)	x	
poke (Phytolacca americana)	x	
purselane (Portulaca oleracea)	x	x
sedge (CYPERACEAE)	x	x
squash (CUCURBITACEAE)	x	x
tobacco (Nicotiana sp.)	x	x
umbel (UMBELLIFERAE)	x	
yellow poplar (Liriodendron tulipifera)	x	

The presence of tobacco seeds within well fill from the James Fort Period (1611-1617) corroborates the historical narrative of tobacco cultivation at the settlement. The native tobacco *Nicotiana rustica* was widely cultivated by the Virginia Indians at the time of the colonial encounter and the species was important both medicinally and ceremonially. The Powhatans introduced this species to the English colonists, who found its smoke too strong and harsh for their tastes. It was a different species of tobacco, *Nicotiana tabacum* (native to tropical and subtropical America), which was introduced from the West Indies through James Fort and which became a critical economic commodity in the British colonies. The recovery of tobacco seeds from JR2158Z, STR 177 coincides elegantly with the historical record of John Rolfe's import of

Trinidadian *Nicotiana tabacum* seed in 1612, and its subsequent rigorous cultivation at Jamestown.

The recovery of oak flowers provides a strong indicator of the seasonality of the well infilling. In tidewater Virginia, a wide variety of oak tree species bloom in late April and early May. Oak flowers are delicate, and while they are abundant during bloom time, they quickly disintegrate. The presence of oak flowers within JR2158Z documents the filling of this level of the well during the mid-spring.

Summary

A wealth of information has been generated through the analysis of archeobotanical materials from the James Fort well. This current effort adds to a growing archeobotanical dataset from the feature (Archer 2006, McKnight 2002), and suggests that additional plant studies within the Fort are strongly warranted.

Success in recovering tobacco seeds from the James Fort well deposits provides a unique opportunity to explore the timing of the transition from *Nicotiana rustica* to *Nicotiana tabacum* in the early English colony. The archeobotanical record at James Fort has the potential to flesh out the historical record and to better reconstruct the rich history of James Fort and early colonial life on the Chesapeake frontier.

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