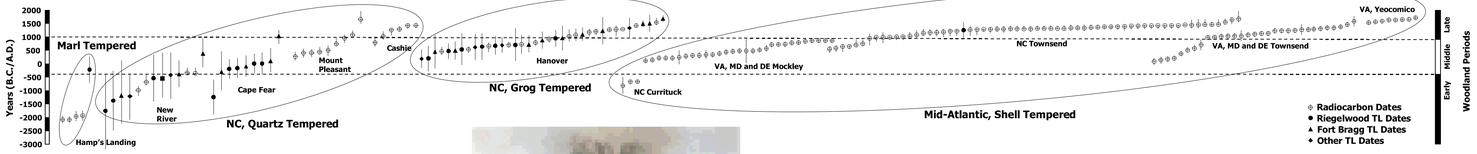
Shell Tempered Pottery of the Middle Atlantic

Chronometric Data for Selected Middle Atlantic Pottery Types



History of Shell Tempering in the Middle Atlantic

Throughout much of Eastern North America, the use of shell for tempering pottery increased dramatically during the Late Woodland and Early Mississippian periods (ca. A.D. 700–1100). Noting the timing of this pan-regional phenomenon, archaeologists have reasoned that it may be functionally linked to other broad-scale economic trends such as corn agriculture and more sedentary residence patterns that emerged at about the same time. Behind the general pattern however, lie causes specific to each region and culture. This synopsis of the origin and distribution of shell-tempered pottery in the Middle Atlantic provides a regional context in which to explore the broader issues.

Late Woodland

The Late Woodland Townsend series is generally understood as the shell-tempered ceramic tradition of Eastern Algonkian speakers who moved south into the Chesapeake and Mid-Atlantic region around A.D. 600–800. An important source of evidence for this population radiation is a linguistic divergence that occurred at about this time (Fiedel 1990; Luckenbach et al. 1987). The archaeological record also reflects a regional cultural identity in the technological and stylistic similarity of shell-tempered Townsend series pottery (including the North Carolina Colington and White Oak types) and a host of other culture traits such as ossuary burials occurring in Tidewater North Carolina and Virginia, the Lower Potomac of Maryland and the Delmarva Peninsula (Curry 1999:5–7). Evidence that this culture was intrusive may also be seen in the precipitous cessation of rhyolite exchange and manufacture of stemmed points at the close of the Middle Woodland Selby Bay phase in the Chesapeake region.

Middle Woodland

Lexicostatistical evidence for an earlier wave of Algonkian expansion is less compelling and the associations of material culture more difficult to explain. Consequently, the Middle Woodland Mockley series (A.D. 200—900) is variously interpreted as evidence of a prior Algonkian migratory event (Luckenbach et al. 1987), or local innovation. Nevertheless, shell-tempered Mockley ware occurs in approximately the same vicinity as the subsequent Townsend series, although surface treatments in these two series appear to be mutually exclusive.

Early Woodland

The earlier (Early Woodland?) shell-tempered Currituck ware appears to have predated Mockley. Unfortunately, the sole dates for Currituck (800–600 B.C.) are not accompanied by a technical report of excavations or a coherent body of records. Notwithstanding this, Currituck pottery, with its unique flat bases and foot rings, appears to represent an indigenous shell-tempering tradition in the Albemarle region of North Carolina and southern Tidewater Virginia. The Water Lily type, found in approximately the same area, seems to represent an even earlier shell-tempered type. The entire technological package for Water Lily (thick, slab-built, low-fired, flat-bottomed dishes with lug handles) closely resembles Stallings except that Water Lily is tempered with crushed shell, not fiber.

Conclusions

Archaeological evidence indicates that shell tempering is present in the Middle Atlantic from the earliest point at which pottery making technology first emerges, and is continuously represented thereafter until the time of historic European colonization. Contemporary with shell-tempered pottery in each of these periods are several types of quartz- or grog-tempered pottery (e.g., the North Carolina series represented in the chronometric chart above). Although these different pottery making technologies may represent the practices of distinct culture groups, it is clear that they co-existed within the same region among people whose foraging or food production strategies are assumed to have been very similar.

John White (1584) water color illustration based on his experience with the Algonkian people of Roanoke Island, NC. Note similarity with Yeocomico vessel on the right.

Yeocomico Cord Marked jar from the Cumberland site (18CV171/129), Calvert County, Maryland. Photo courtesy of the Maryland Archaeological Conservation Laboratory, Jefferson Patterson Park and Museum.

Yeocomico (A.D. 1500–1700)

Yeocomico was defined based on sherds collected from the White Oak Point Site (44WM119), Westmoreland County, Virginia (Waselkov 1982:294–297) and the Bluefish Beach site, Northumberland County Virginia (Potter 1982:376–379). Evans (1955) defined three types in the Chickahominy Series that are similar to Yeocomico: Sussex Plain, Potts Scraped and Potts Cord-Wrapped Dowel. Binford's (1965) Warekeck type is also similar to Yeocomico.

Chronology
Six radiometric dates from White Oak Point and Bluefish Beach indicate that the Yeocomico series dates from ca. A.D. 1500 – A.D. 1700.

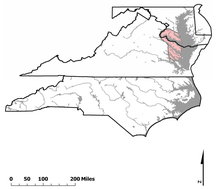
Paste/Temper
Temper consists of fine to coarse crushed oyster shell (1–5mm) in 10–20% proportion.

Morphology
Vessels are coil-built and paddled. Vessel forms include cups, bowls, and jars. Bowls are hemispherical in form, while jars are globular or semiconoidal with slightly everted rims. Rims are straight or excurvate and lips are rounded, tapered, or flattened. Vessel wall thickness ranges from 4 – 8mm, with orifice diameters ranging from 15–23cm.

Surface Treatment
Exterior surfaces are smoothed, scraped, or cord marked. Interior surfaces are usually smoothed or scraped.

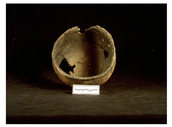
Decoration
Vessels have two distinct forms of decoration, (1) vertical or slightly oblique lines of punctations, or (2) horizontal or oblique cord-wrapped-stick (paddle edge) impressions, both found on the upper rim.

Yeocomico Distribution



Townsend Corded Horizontal from the Townsend site (7S-G-2). Photo courtesy of the Maryland Archaeological Conservation Laboratory, Jefferson Patterson Park and Museum.

Townsend Series, Colington Simple Stamped from the Fort Raleigh Site. Photo courtesy of the National Park Service, Fort Raleigh National Historic Site, Manteo, NC.



White Oak Fabric Impressed from the Garbacon Creek site (31CR86), Carteret County, NC. Photo courtesy of the UNC Research Laboratories of Archaeology.

Townsend (A.D. 900–1590)

Blaker (1963:14-21) originally defined the Townsend Series for pottery from the Townsend site, Lewes, Delaware. The series includes Rappahannock Fabric Impressed and Rappahannock Incised, Townsend Incised, Townsend Corded Horizontal and Townsend Herringbone types. Griffith (1982) refined the definition of Rappahannock Incised, identifying four categories based on collections from Maryland's Eastern Shore. Egloff and Potter (1982:108-109) suggested that Evan's (1955) Chickahominy Fabric-Impressed and Chickahominy Incised be subsumed by Rappahannock types, and Herbert (2003) suggested that and Loftfield's (1979) White Oak Fabric Impressed and Phelps' (1983) Colington Fabric Impressed also be considered part of the Townsend series.

Chronology
Radiocarbon and TL dates for Townsend wares range from A.D. 110 – A.D. 1590.

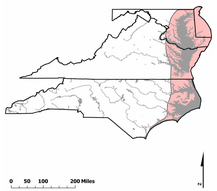
Paste/Temper
Townsend temper consists of fine-to-coarse crushed shell in moderate proportion. Maryland researchers report the use of unburned shell (usually ribbed mussel or oyster) composing 10 – 20% of the matrix.

Morphology
Townsend wares are coil-built and paddled. Vessels are typically conoidal jars, though bases are sometimes globular. Rims are often straight or everted and rarely folded Lips are rounded or flattened occasionally by stamping. A series of parallel, vertical paddle-edge impressions is commonly found around the interior of the rim, especially in collections from northern North Carolina. Vessel size ranges from miniature pots to large cooking vessels.

Surface Treatment
Exterior surfaces are typically fabric-impressed, often utilizing a fabric-wrapped paddle. Impressions reflect weft-faced plaiting over non-cordage warps stamped perpendicular, oblique, or parallel to the rim. After A.D. 1200, simple stamping is common on the northern coast of North Carolina. Occasionally exterior surfaces are smoothed after stamping, or stamping is executed on a partially dry paste. Interior surfaces are smoothed.

Decoration
Many vessels in the Townsend Series are incised with a broad shallow line, directly cord-impressed, or paddle-edge impressed. All decorations occur on the exterior below the lip of the rim.

Townsend Distribution



Mockley Cord Marked from the Piscataway site (18PR7), Prince Frederick County, MD. Photo courtesy of the Maryland Archaeological Conservation Laboratory, Jefferson Patterson Park and Museum.

Mockley Net Impressed from the Great Neck site (44VB7), Virginia Beach, VA. Photo courtesy of the Virginia Department of Historic Resources.

Mockley (A.D. 120–880)

Mockley was first defined by Stephenson et al. (1963: 105) based on pottery from the Accokeek Creek site (18PR8) in Prince Georges County, Maryland. Evans (1955) also described three types similar to Mockley: Chickahominy Cord-Marked, Potts Net-Impressed, and Potts Roughened (Egloff and Potter 1982:103).

Chronology
Radiometric dates associated with Mockley range from A.D. 120 – 880.

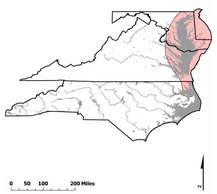
Paste/Temper
Mockley vessels are typically tempered with coarsely crushed oyster shell, ranging in size from0.5 to 5 mm in proportions of 20% – 30%.

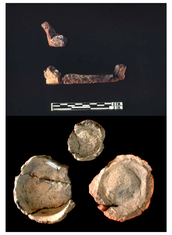
Morphology
Vessels are coil-built and paddled. Vessel forms include mostly medium and large open jars, with semi-conoidal or globular bases and straight-sides. Lips are usually rounded. Rims are straight or slightly flaring, or rarely inverted and everted. A small percentage of Mockley jars from the Great Neck site () and elsewhere on the Virginia coast are flat bottomed.

Surface Treatment
Exterior surfaces are net-impressed, cord-marked or plain smoothed. Net-impressions were made with open-weave knotted net, with knot spacing ranging from 2 – 6 mm. Cord-marking impressions were made with medium to coarse cordage spaced at intervals of 3 – 10 mm. Cord impressions are oriented vertically, horizontally, diagonally and occasionally over-stamped. Interior surfaces are smoothed or occasionally scraped.

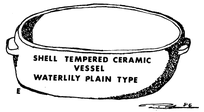
Decoration
Vessels are generally undecorated, but occasionally the area below the rim is smoothed and incised with crude, broad-line chevrons, diamonds, cross-hatches, parallel lines, or rarely punctations (Egloff and Potter 1982:103).

Mockley Distribution





Water Lily Plain lug handle, from the Great Neck site (44VB7), Virginia Beach, VA. Photo courtesy of the Virginia Department of Historic Resources.



Water Lily Plain, slab-built, flat-bottomed, oval dish with lug handles. Illustration from Painter (1987:26, Figure 3).

Water Lily

The Water Lily series was first described by Painter (1977:48, 1987:20–21) for pottery found by D. Prescott at Water Lily, Currituck County, North Carolina. No systematic analysis of this ware has been attempted and the whereabouts of the original collection is not known.

Chronology
No chronometric data for this series exists. Vessel form suggests an Early Woodland affiliation.

Paste/Temper
Painter describes the paste as shell tempered. Several specimens from Virginia coastal sites were analyzed for this study. In this sample, abundant fine to moderate sized (1–5mm) shell was added to the paste. Vessels are assumed to have been low fired as ceramic is very soft.

Morphology
Vessels were formed as oval, flat-bottomed open pots, or dishes, with straight walls and lug handles at either end. Vessel walls are thick (10–12mm). Vessel bottoms and the lower portion of the walls were clearly slab built and, given this, it is not likely that the upper walls were coiled and paddled.

Surface Treatment
Painter describes only plain surfaces, but the specimens analyzed for this study suggested smoothed-over knotted net impressing.

Decoration
No decoration has been observed on Water Lily vessels.

Currituck flat-bottomed bases from the Great Neck site (44VB7), Virginia Beach, VA. Photo courtesy of the Virginia Department of Historic Resources.

Currituck Beaker from the Currituck site (31CK7), Currituck, NC. Photo courtesy of the Museum of the Albemarle, Elizabeth City, NC.

Currituck

The Currituck series was first described by Painter (1976, 1977, 1978, 1987) for pottery found at the Currituck site in Currituck County, North Carolina. Published descriptions of excavations at the site and of Currituck pottery are limited, and the artifacts are scattered among several institutions and individuals. Among researchers working in coastal Virginia today, the Currituck and Mockley pottery types are considered to be synonymous, or at least part of a continuous series.

Chronology
Three radiocarbon dates reported from the Currituck site range from 810–660 B.C. (Painter1978:67). One of these dates (660±60) was derived from charcoal from a feature containing Currituck pottery (Painter 1977:54).

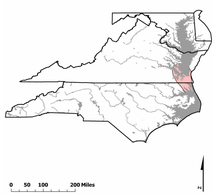
Paste/Temper
Painter (1977:47–48) initially described shell-tempered, sand-tempered and grog-tempered varieties. Later he included fiber tempering (Painter 1990:27) as a characteristic of Currituck pottery. Among the samples of Currituck pottery curated at East Carolina University that were analyzed from this study, no fiber-tempered and no grog-tempered specimens were noted. Fine to very coarse, sub-rounded quartz sand was included in moderate to high proportion (10–30%) along with crushed oyster shell in most specimens analyzed. Several bases bore impressions of fiber on their exterior surfaces and several samples included abundant pebble-sized ferric concretions that could easily have been mistaken for grog.

Morphology
Vessels were thick walled (10–12mm), coil built and paddled. About 70% of the bases analyzed in the ECU collection were very thick, conical or sub-rounded and about 30% were flat-bottomed. Vessel forms include jars (some very large) with straight or flaring walls and direct rims. Lips are generally rounded, but sometimes flattened by stamping and occasionally notched or nicked with the paddle edge along the inner rim.

Surface Treatment
Surface treatments described by Painter included net-impressed, cord-marked and fabric-impressed. Among the specimens analyzed for this study, only net-impressed and plain (smoothed) surfaces were noted.

Decoration
No decoration of Currituck pottery is known.

Water Lily and Currituck Distribution



Replication of Possible Prehistoric Shell-tempering Practices

Attempts to explain regional shifts to shell tempering have often drawn on the results of materials science studies demonstrating that the platy structure of shell particles adds strength and thermal shock resistance to pottery (Feathers 1989, 1990, 2002; Steponaitis 1983, 1984). Such explanations are complicated by the fact that calcite ($CaCO_3$) undergoes chemical transition to calcium oxide (lime) when fired to 600–800°C (Rice 1987:97–98). Upon cooling as lime rehydrates it expands. If this occurs within the body of the ceramic it weakens the vessel and may cause it to crumble. This may be avoided if the firing temperature is held below the critical temperature (600°C), or if the shell is pre-fired and allowed to slake prior to adding as temper. To explore the effects of these preventative measures when executed in an anthropologically appropriate context, four shell-tempered replicas were made with local clay and crushed oyster shell. Two pots were tempered with raw shell and two with pre-fired shell. Two pots (one pot of each temper type) were fired in an open fire to a temperature of about 700°C and the remaining two pots (again one of each temper type) were fired in a reduced atmosphere to a temperature of just over 500°C.

Preparing Shell Temper

Shell was prepared in two ways: pre-fired and "raw." In both cases the oysters used were three years old or older and harvested in sub-tidal, saline water. Consequently, they were large, hardly individuals with thick left valves and umbos. One batch was fired in an open fire by spreading out a single layer of shell under moderately sized hardwood fire, built up and then allowed to burn out without refueling. Temperatures probably ranged from 500–700°C, although they were not measured. A second batch of shell was not burned. Both batches were then crushed and size sorted through ¼-in mesh, eliminating sizes > 5mm.

Building Shell-tempered Pots

All size fraction < 5mm, were added to the clay matrix in 25% proportion by volume. This modified the clay's performance in two ways. First, the plasticity and strength of the clay-was greatly reduced, rendering it barely workable. Second, the resulting very high porosity greatly speeded drying time, requiring quick building. Vessels were coil-built and paddled with a simple-stamped paddle. With the loss of plasticity and strength, vessel walls tended to sag and were prone to splitting vertically.

11:20am: Initial pre-heating.

12:20pm: Intensive pre-heating and cooking lunch.

1:30pm: Firing, no oxygen reduction (700°C

Firing Shell-tempered Pots

Four medium sized open bowls were made of clay, tempered with 25% crushed oyster shell. Two were tempered with raw shell and two with pre-fired shell. One raw-shell and one fired-shell vessel were fired in an open fire with no attempt to reduce oxygen. The maximum temperature recorded in this firing was 698°C, but it is possible that some areas of the fire were as much as 100° C hotter. Similarly, one raw-shell and one fired-shell vessel were fired in a reduced-oxygen environment. In this firing, the maximum temperature recorded was 513° C. Hotter spots are possible, but not likely to have exceeded 600°C.

2:20pm: Intensive pre-heating second batch.

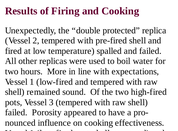
2:40pm: Adding green bamboo fuel.

3:00pm: Reduced atmosphere (250°C

3:40pm: "Reduced" atmosphere (500–600°C max).

Results of Firing and Cooking

Unexpectedly, the "double protected" replica (Vessel 2, tempered with pre-fired shell and fired at low temperature) spalled and failed. All other replicas were used to boil water for two hours. More in line with expectations, Vessel 1 (low-fired and tempered with raw shell) remained sound. Of the two high-fired pots, Vessel 3 (tempered with raw shell) failed. Porosity appeared to have a pronounced influence on cooking effectiveness. Vessel 1 (low-fired, raw shell-tempered) and Vessel 3 (high-fired, raw shell-tempered) actually leaked, greatly reducing heat transfer to the contents of the vessel.



Replica vessels 1, 3 and 4 are used to boil water for approximately two hours.

Vessel 1: Fired in reduced atmosphere (500°C); temper is raw, crushed oyster shell at 25% by volume. Vessel is sound, no evidence of lime spalling.

Vessel 2: Fired in reduced atmosphere (500–600° C); temper is pre-fired, crushed oyster shell at 25% by volume. Note lime spalling and vessel wall failure.

Vessel 3: Fired with no oxygen reduction (700°C); temper is raw, crushed oyster shell at 25% by volume. Vessel is sound, no evidence of lime spalling.

Vessel 4: fired with no oxygen reduction (700°C); temper is pre-fired, crushed oyster shell at 25% by volume. Vessel is sound, no evidence of spalling.

Replica vessels 1, 3 and 4 are used to boil water for approximately two hours.

Vessel 1, used to boil water for approximately two hours, remained sound but shows some lime spalling on exterior.

Vessel 2 spalled and failed prior to cooking experiment.

Replica vessel 3, used to boil water for approximately two hours, spalled to the point of failure.

Replica vessel 4, used to boil water for approximately two hours, remained sound.

Conclusions

Although the results of this "re-creational" experiment were quite limited, they nevertheless suggest several interesting implications for modeling the prehistoric technological practice of tempering clay pots with crushed shell.

- Temperature control when pre-firing shell is quite critical as it must invoke the calcite-to-lime inversion, which requires a *very* hot fire.
- Adding crushed shell to clay in moderately high proportion can have a pronounced effect on clay workability, reducing plasticity and strength and increasing porosity and hence, drying speed.
- Temperature control when low firing shell-tempered pots requires very specific protocol as the required range (500–600°C) is narrow.
- Some provision must be made to reduce porosity, otherwise shell-tempered pots are too leaky to be good cooking pots.

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