

# Boiling in the Middle Savannah: Simulation Experiments Comparing Indirect- and Direct-Heat Cooking in Stallings Replica Vessels

Emily R. Bartz (University of Florida); emily.bartz@ufl.edu

## Introduction:

In support of the interpretation of organic residues from North America's oldest pottery, Late Archaic Stallings fiber-tempered wares of the middle Savannah River Valley (ca. 4500 – 3800 cal. BP), an experimental project was recently conducted to examine the residue absorption patterns resultant of indirect-heat and direct-heat cooking. In recent decades, experimental methods in organic residue analysis (ORA) have been applied in the study of vessel use, providing insights into what types of resources were processed in archaeological vessels, and mode of vessel use (i.e., roasting, boiling, steaming, fermenting, etc.). Whether or not backed by experimental work, all published studies of organic residues in hunter-gatherer pottery involve direct-heat cooking. However, the residue distribution resulting from indirect-heat boiling (i.e., stone-boiling), a common cooking method among Late Archaic pottery users of the American Southeast, has never before been investigated.



## Experimental Overview:

Replica fiber-tempered vessels were crafted in the likeness of Early Stallings (ca. 4500 – 4100 cal. BP) flat-bottom basins, used for indirect-heat cooking simulations, and Classic Stallings (ca. 4100 – 3800 cal. BP) hemispherical bowls, used for direct-heat cooking simulations. A range of food resources were processed via these two cooking methods and samples have been submitted for ORA. Organic residue analysis involves the extraction of compounds accumulated on, or absorbed into, the ceramic matrix of a vessel, which are then analyzed using Gas Chromatography-Mass Spectrometry (GC-MS) techniques to identify the composition and abundance of residues. Multiple samples (i.e., rim, body, and base) have been cut from each of the experimental vessels in order to compare rates of residue absorption along the vessel profile resultant of indirect- and direct-heat boiling.

## Stallings Vessel and Soapstone Cooking-Slab Replication:

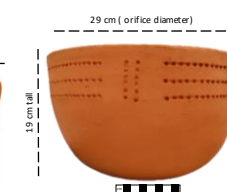
In total, eight replica vessels were used in this experiment, four flat-bottomed basins and four hemispherical bowls. In general, one vessel required around 14 pounds of wet clay, three cups of compacted Spanish moss, and 1 ¼ cups of medium grit sand. The moss was thoroughly dried and chopped into smaller pieces before adding to the clay. The replica vessels were shaped using a slab-mold, or drape-mold technique, in which a thinned slab of clay was draped and smoothed over a mold. After many unsuccessful attempts at firing the pots in an open campfire, the vessels used in this experiment were kiln fired at 700-800°C in a neutral/oxidizing atmosphere. Soapstone slabs were crafted from Virginia soapstone nodules, shaped using a band saw and a hole was drilled through the slab so that a stick could be used to transfer the hot rocks from the fire to the cooking pot and vice versa.



Early Stallings Basin Replica

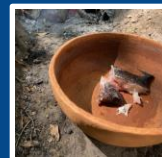
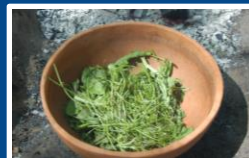


Classic Stallings Bowl Replica



## Cooking Simulations:

An ORA pilot study conducted in the fall of 2021 demonstrated that all Stallings vessel forms, throughout the Stallings period of the middle Savannah River Valley, were used to process a wide range of resources, including both aquatic and terrestrial animals, as well as plants. In an effort to recreate cooking scenarios similar to those employed by Stallings peoples, a variety of resources were chosen to encompass the broad resource groups identifiable through GC-MS ORA; 1) plant, 2) aquatic animal, and 3) terrestrial animal. For both vessel forms/cooking methods, one vessel was used to boil plants, a second vessel was used to boil fish, a third vessel was used to boil terrestrial meat, and a fourth vessel was used to boil a combination of all three resource types. Each vessel was used to boil foods for 20 minutes, three times.



## Sampling:

To establish regions of lipid accumulation within a vessel, samples (c. 2 x 2 cm) were taken from three different points along the vertical profile of each experimental vessel (n = 8) (i.e., rim, body, and base), totaling 24 experimental samples submitted for ORA. *Rim samples* were taken 3 cm below the vessel lip. *Base samples* were taken from the lowest 2 cm of the vessel wall (the point where the vessel touches the surface it rests on, to 2 cm above). *Body samples* were taken halfway between the rim and base samples of each vessel.



## Archaeological Significance:

Residue distribution and accumulation data from this project have the potential to identify patterns unique to indirect-heat cooking that can be used as a method for inferring vessel use in studies of early pottery use elsewhere. Furthermore, this project will provide baseline reference data to enhance the interpretation of organic residues from Stallings pottery. While the ORA results are pending, we learned a lot about Stallings vessel manufacture and use in this experimental process.

- To use Spanish moss as an effective temper, it needs to be thoroughly dried and chopped into smaller pieces.
- Stallings vessel likely required a sealant to adequately hold and boil liquid-based contents. The use of pine resin as a sealant corroborates ORA results from the pilot study.
- On average, 16 soapstone cooking-slabs were needed to reach and maintain a boil for 20 minutes. Stones at temperatures above 500°C are ideal.
- It is faster to reach boiling temperatures with stone-boiling, but direct-heat cooking requires less energy and attention.



## Acknowledgments:

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