

WOODLAND POTTERY SOURCING IN THE CAROLINA SANDHILLS

edited by
Joseph M. Herbert
and
Theresa E. McReynolds

with contributions by
Michael D. Glascock **Joseph M. Herbert**
Theresa E. McReynolds **Paul A. Schroeder**
Sheldon A. Skaggs **Michael S. Smith**
Robert J. Speakman **Vincas P. Steponaitis**

Prepared by the Cultural Resources Management Program, Fort Bragg and the Research Laboratories of Archaeology, University of North Carolina at Chapel Hill. Submitted to the U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) in partial fulfillment of contract DACA42-02-D-0010, Delivery Order 5.

Research Report 29
Research Laboratories of Archaeology
University of North Carolina
Chapel Hill, NC 27599-3120

October 2008

© 2008 by the Research Laboratories of Archaeology,
The University of North Carolina at Chapel Hill. All rights reserved.

Abstract

This study compares local clays with pottery from archaeological sites in the Carolina Sandhills, Piedmont, and Coastal Plain to explore patterns of residential mobility and resource use among people living in the Fort Bragg region of the Sandhills during the Woodland period (ca. 1500 BC–AD 1600). The performance characteristics of clays from each region were assessed through experiments that served to focus the study on anthropologically appropriate clay samples, i.e., those that might actually have been used to make pottery. Neutron activation analysis (NAA), X-ray diffraction (XRD), and petrography were combined to characterize regional variation in the chemical and mineral constituents of prehistoric pottery and clay resources in order to identify the sources of raw materials used to make pottery found on Sandhills sites.

Although it is often assumed that serviceable clay is ubiquitously distributed across the Carolina landscape, this study demonstrates that clay resources with the right combination of strength and plasticity are difficult to find and may be largely absent from some regions. Replication experiments revealed that there are very few clay resources in the North Carolina Sandhills that are suitable for making pottery vessels, suggesting that most pottery found on Fort Bragg sites was made from nonlocal resources and subsequently transported into the region.

The results of geochemical and mineralogical analyses support this conclusion. They confirm that Piedmont and Coastal Plain resources are compositionally distinct. They also indicate that most Fort Bragg pottery samples more closely resemble Coastal Plain and Piedmont resources than local Sandhills materials. The available evidence indicates that Coastal Plain resources may be better represented among the Sandhills sherds than Piedmont resources, but at least three Fort Bragg sherds appear to have been fashioned from Piedmont materials.

The significant implication of these results is that pottery was transported over broad regions, implying that the acquisition of pottery from distant sources was a routine feature of Woodland-period subsistence in the Sandhills. Such materials could have been obtained through high levels of residential mobility, exchange, or both, and we recommend that additional studies be designed to evaluate the specific strategies Woodland people used to obtain pots.

Table of Contents

Abstract *iii*
List of Figures *vii*
List of Tables *xi*
Preface *xiii*

1. Introduction *1*

Woodland Occupation of the North Carolina Sandhills *2*
Sourcing Ceramics *3*
Research Design *4*
Organization of this Volume *5*

2. Geology *7*

The Carolina Coastal Plain *7*
The North Carolina Piedmont *9*
River Basins and Drainages *12*
Conclusion *17*
Notes *17*

3. Ceramics *18*

Piedmont Sites and Samples *18*
Sandhills Sites and Samples *22*
Coastal Plain Sites and Samples *23*
Notes *29*

4. Clays *30*

Sample Collection *30*
Sample Descriptions *31*
Performance Trials *41*
Discussion *52*
Conclusions and Implications *54*
Notes *55*

5. Geochemistry *56*

Interpreting Chemical Data *56*
Chemical Composition of Pottery *59*
Chemical Composition of Clays *62*
Conclusions *72*
Notes *72*

6. Petrography *73*

Petrographic Criteria for Characterizing Pottery and Clays *73*

Results: Ceramic Samples 76
Results: Clay Samples 87
The Question of Added Temper 101
Conclusions 106

7. Feldspar and Clay Mineralogy 108

X-Ray Diffraction 108
Results 110
Discussion 116
Conclusions 118
Notes 121

8. Conclusions 122

Clay Performance Trials 122
Neutron Activation Analysis 124
Petrography 125
X-Ray Diffraction 127
National Geochemical Survey 127
Discussion 130
Conclusions 140
Notes 141

Appendixes

A. Pottery Sample Descriptions 142
B. Clay Sample Descriptions 171
C. Geochemical Data 220
C. Petrographic Data 234

Bibliography 240

List of Figures

- 1.1. The Sandhills region of the Carolinas 3
- 1.2. Distance from clay source to pottery production locale for 108 ethnographic cases 5
- 2.1. Major physiographic regions of the Carolinas 8
- 2.2. Geologic features of the Carolina Coastal Plain 9
- 2.3. Cretaceous deposits of the North Carolina Coastal Plain 10
- 2.4. Geologic features of the eastern Piedmont 11
- 2.5. Rivers and river basins mentioned in the text 13
- 2.6. The Cape Fear River basin 14
- 2.7. The Yadkin-Pee Dee River basin 15
- 2.8. The Lumber River basin 16
- 3.1. Archaeological sites from which pottery samples were drawn 19
- 3.2. Pottery samples from the Haw River site (31Ch29) 22
- 3.3. Pottery samples from the Doerschuk site (31Mg22) 23
- 3.4. Pottery samples from Fort Bragg sites in the Lower Little drainage 24
- 3.5. Pottery samples from Fort Bragg sites in the Drowning Creek drainage 25
- 3.6. Pottery samples from the Breece site (31Cd8) 26
- 3.7. Pottery samples from the Waccamaw site (31Cb5) 27
- 3.8. Pottery samples from the Kolb site (38Da75) 28
- 4.1. “Coil” test to evaluate plasticity 32
- 4.2. Joe Herbert using a bucket auger to collect an upland clay sample from a tree fall 33
- 4.3. Clay and pottery sample locations 34
- 4.4. Clay and temper sample locations in the Lower Little, Drowning Creek, and Cape Fear drainages 35
- 4.5. Clay sample locations in the Pee Dee drainage 36
- 4.6. Clay sample locations in the Waccamaw drainage 37
- 4.7. Clay and temper sample locations in the Haw drainage 39
- 4.8. Clay and temper sample locations in the Yadkin drainage 40
- 4.9. Clay and temper sample locations in the Deep drainage 41
- 4.10. Laboratory performance tests to evaluate workability 43
- 4.11. A lean sample (FBR018) 44
- 4.12. A good sample (FBR040) 44
- 4.13. A moderately lean sample (FBR044) 45
- 4.14. Boxplots of linear drying shrinkage values for each drainage 47
- 4.15. Boxplots of percentage water of plasticity values for plastic, moderately plastic, and weakly plastic samples 49
- 4.16. Boxplots of percentage water of plasticity values for good, moderately lean, and lean samples 50
- 4.17. Building a replica pot from sample FBR040 using the coil method 51
- 4.18. Replication results for Cape Fear sample FBR011 51
- 4.19. Replication results for Pee Dee sample FBR020 52
- 4.20. Replication results for Haw River sample FBR035 53
- 4.21. Firing replica pots 54

- 5.1. Biplot of principal components 1 and 2 derived from PCA of pottery and clay samples, based on the full data set (30 elements) 63
- 5.2. Biplot of principal components 1 and 4 derived from PCA of pottery and clay samples, based on the full data set (30 elements) 63
- 5.3. Scatter plot of principal components 1 and 4 derived from PCA of pottery and clay samples, based on the full data set (30 elements) 64
- 5.4. Scatter plot of Cs and Sm concentrations, illustrating possible subgroups within Group 1 64
- 5.5. Scatter plot of Lu and Th concentrations, illustrating possible subgroups within Group 2 65
- 5.6. Three-dimensional scatter plot of Ca, Na, and Mn concentrations, illustrating the differences among the five compositional groups 65
- 5.7. Biplot of principal components 1 and 3 derived from PCA of pottery and clay samples, based on the reduced data set (10 elements) 66
- 5.8. Scatter plot of principal components 1 and 3 derived from PCA of pottery and clay samples, based on the reduced data set (10 elements); only pottery samples are shown 67
- 5.9. Scatter plot of principal components 1 and 3 derived from PCA of pottery and clay samples, based on the reduced data set (10 elements); only clay samples are plotted 67
- 6.1. Ceramic petrographic thin section illustrating the orientation of the cross section and some common attributes analyzed in this study 74
- 6.2. ACF in pottery sample JMH068 77
- 6.3. Diabase rock fragment in pottery sample JMH006 81
- 6.4. Coarse to very coarse, blocky to subangular quartz mineral and rock fragments in sample JMH046 82
- 6.5. A polygranular quartz rock fragment with sutured grain boundaries in sample JMH034 82
- 6.6. Polygranular quartz + K-feldspar (microcline) + mafic igneous rock fragments in sample JMH033 83
- 6.7. Highly-altered quartz + feldspar rock fragments and feldspar mineral fragments in sample JMH048 84
- 6.8. Carbonized plant fragment with separation void in sample JMH034 85
- 6.9. Sedimentary or metasedimentary rock fragments in sample JMH058 86
- 6.10. Clay sample FBR010 dominated by very fine- and fine-grained, subrounded and subangular quartz 90
- 6.11. Clay sample FBR005 with coarse-grained quartz and feldspar mineral fragments and quartz rock fragments 90
- 6.12. Clay sample FBR067 tempered with 10% quartz sand 91
- 6.13. Clay sample FBR009 with very fine- and fine-grained quartz and muscovite 92
- 6.14. Clay sample FBR059 with fine- to coarse-grained, angular to subangular quartz mineral and rock fragments 92
- 6.15. Clay sample FBR067 with fine- and medium-grained, blocky to subrounded quartz and feldspar mineral fragments 93
- 6.16. Clay sample FBR017 with fine- and medium-grained, subangular and angular quartz, feldspar, and opaque mineral fragments; quartz rock fragments; and dark red hematite-stained clay clots with quartz mineral inclusions 93
- 6.17. Clay sample FBR041 with fine to very coarse fragments of quartz, plagioclase, opaque minerals, an unknown high relief mineral, and sedimentary rock 94

- 6.18. Clay sample FBR006 with very fine-grained clay, dark red-black hematite-stained clay clots, and fine- to medium-grained quartz mineral fragments 95
- 6.19. Quartz rock fragments and K-feldspar (microcline) in clay sample FBR011 95
- 6.20. Red hematite-stained clay clots in clay sample FBR027 97
- 6.21. Clay sample FBR081 with subrounded to subangular quartz mineral fragments 97
- 6.22. Clay sample FBR049 with subangular quartz and opaque mineral fragments and abundant fine- and medium-sized, subrounded and elliptical red hematite-stained clay clots 98
- 6.23. Clay sample FBR055 with fine- and medium-grained quartz and feldspar mineral fragments, quartz + feldspar rock fragments, and rounded red hematite-stained clay clots 98
- 6.24. Clay sample FBR058 with fine- to medium-grained quartz mineral fragments and some rounded red hematite-stained clay clots 99
- 6.25. Clay sample FBR080 with subrounded quartz rock fragments and quartz mineral fragments 99
- 6.26. Clay sample FBR071 with abundant very fine-grained quartz minerals, red hematite-stained clay clots, and a few coarser-grained quartz mineral fragments 100
- 6.27. Clay sample FBR074 with coarse, polygranular metasedimentary rock fragments, quartz + feldspar rock fragments, and quartz mineral fragments 100
- 6.28. Clay sample FBR023 tempered with local grog 103
- 6.29. Clay sample FBR011 tempered with nonlocal grog 103
- 6.30. Clay sample FBR040 tempered with crushed quartz fragments 105
- 6.31. Clay sample FBR040 tempered with metavolcanic rock fragments 105
- 6.32. Clay sample FBR040 tempered with unweathered diabase rock fragments 106
- 7.1. Locations of 42 clay samples analyzed by XRD 109
- 7.2. Clay samples plotted according to relative proportions of plagioclase, K-feldspar, and the 10Å illite/mica group minerals and arrayed by drainage 116
- 7.3. Clay samples plotted according to relative proportions of 10Å, 14Å, and 7Å minerals and arrayed by physiographic region 117
- 7.4. Clay samples plotted according to relative proportions of 10Å, 14Å, and 7Å minerals and arrayed by workability 119
- 7.5. Good and moderately lean clay samples plotted according to relative proportions of plagioclase, K-feldspar, and 7Å minerals 119
- 7.6. Clay samples plotted according to relative proportions of plagioclase, K-feldspar, and 7Å minerals and arrayed according to hardness 120
- 7.7. Clay samples plotted according to relative proportions of 10Å, 14Å, and 7Å minerals and arrayed according to linear drying shrinkage 120
- 7.8. Clay samples plotted according to relative proportions of plagioclase, K-feldspar, and 10Å minerals and arrayed according to linear drying shrinkage 121
- 8.1. Clay sample locations and workability classes 123
- 8.2. Scatter plot of Na and Ca concentrations for pottery samples, showing chemical groups 125
- 8.3. Interpolated Ca concentration map prepared by kriging ICP-AES data found in the National Geochemical Survey database 129
- 8.4. Interpolated Na concentration map prepared by kriging NAA data found in the National Geochemical Survey database 130
- 8.5. Interpolated Mn concentration map prepared by kriging ICP-AES data found in the National

- Geochemical Survey database 131
- 8.6. Interpolated Sm concentration map prepared by kriging NAA data found in the National Geochemical Survey database 132
- 8.7. Interpolated Th concentration map prepared by kriging NAA data found in the National Geochemical Survey database 133
- 8.8. Scatter plot of Na and Ca concentrations, comparing Sandhills pottery with clay samples 139
- A.1. Cross sections of pottery samples from Fort Bragg sites in the Lower Little drainage 164
- A.2. Cross sections of pottery samples from Fort Bragg sites in the Drowning Creek drainage 165
- A.3. Cross sections of pottery samples from the Breece site in the Cape Fear drainage 166
- A.4. Cross sections of pottery samples from the Doerschuk site in the Yadkin drainage 167
- A.5. Cross sections of pottery samples from the Haw River site in the Haw drainage 168
- A.6. Cross sections of pottery samples from the Kolb site in the Pee Dee drainage 169
- A.7. Cross sections of pottery samples from the Waccamaw site in the Waccamaw drainage 170
- B.1. Cross sections of untempered test tiles made from Sandhills clay samples 214
- B.2. Cross sections of untempered test tiles made from Coastal Plain clay samples from the Cape Fear and Pee Dee drainages 215
- B.3. Cross sections of untempered test tiles made from Coastal Plain clay samples from the Waccamaw drainage 216
- B.4. Cross sections of untempered test tiles made from Piedmont clay samples from the Haw and Yadkin drainages 217
- B.5. Cross sections of untempered test tiles made from Piedmont clay samples from the Deep drainage 218
- B.6. Cross sections of tempered test tiles made from clay samples collected in the Cape Fear, Pee Dee, Haw, and Yadkin drainages 219

List of Tables

- 3.1. Distribution of Pottery Samples by Physiographic Region and Drainage 20
- 3.2. Distribution of Pottery Samples by Period and Type 21
- 3.3. Pottery Samples from the Kolb Site 28
- 4.1. Results of Workability Performance Tests 46
- 5.1. Principal Components Analysis of the Full Data Set 60
- 5.2. Group Assignments of Pottery Samples 61
- 5.3. Principal Components Analysis of the Reduced Data Set 66
- 5.4. Mahalanobis Probabilities of Group Membership for Pottery Samples 68
- 5.5. Mahalanobis Probabilities of Group Membership for Clay Samples 71
- 6.1. Characteristic Aplastic Inclusions in Petrographic Groups 78
- 6.2. Petrographic Groups Assignments for Ceramic Samples 79
- 6.3. Selected Petrographic Characteristics of Clay Samples 88
- 6.4. Tempered Test Tiles Analyzed 102
- 7.1. Qualitative bulk mineralogy 111
- 7.2. Semi-quantitative mineralogy 113
- 8.1. Assignment of Pottery Samples to Chemical Groups 126
- 8.2. Affinities of Clay Samples to Chemical Groups 127
- 8.3. Assignment of Pottery Samples to Petrographic Groups 128
- 8.4. Assignment of Clay Samples to Petrographic Groups 128
- 8.5. Mean Concentrations of Select Elements in Clay Samples by Drainage 133
- 8.6. Cross Tabulation of Chemical and Petrographic Groups for Pottery Samples 134
- 8.7. Proposed Source Assignments for Piedmont Pottery Samples 135
- 8.8. Proposed Source Assignments for Coastal Plain Pottery Samples 136
- 8.9. Proposed Source Assignments for Sandhills Pottery Samples 138
- A.1. Descriptive Information for Pottery Samples: Provenience 143
- A.2. Descriptive Information for Pottery Samples: Paste and Temper Characteristics 146
- A.3. Descriptive Information for Pottery Samples: Surface Treatment Characteristics 156
- B.1. Descriptive Information for Clay Samples: Provenience 172
- B.2. Descriptive Information for Clay Samples: Physical Properties 176
- B.3. Descriptive Information for Clay Samples: Drying Behavior 184
- B.4. Descriptive Information for Clay Samples: Firing Behavior 196
- B.5. Descriptive Information for Clay Samples: Replication 208
- B.6. Clay Samples Submitted for NAA and XRD Analyses 209
- B.7. Clay Samples Submitted for Petrographic Analysis 210
- C.1. Element Concentrations as Measured by Neutron Activation Analysis (As-Fe) 222
- C.2. Element Concentrations as Measured by Neutron Activation Analysis (Hf-Al) 226
- C.3. Element Concentrations as Measured by Neutron Activation Analysis (Ba-V) 230
- D.1. Selected Petrographic Characteristics of Pottery Samples 235
- D.2. Point Count Data for Pottery Samples 238

Preface

This report is a companion volume to *Stone Quarries and Sourcing in the Carolina Slate Belt* (Steponaitis et al. 2006). Both of these multiyear, interdisciplinary research projects reflect the commitment of the Cultural Resources Management Program at Fort Bragg to understanding the archaeological record of prehistoric cultures inhabiting the Sandhills of North Carolina. The idea for these projects was conceived in what might seem an unlikely setting, a lively holiday party hosted by the Research Laboratories of Archaeology. A conversation with John Rogers, emeritus professor of Geological Sciences at the University of North Carolina at Chapel Hill, concerning the use of samarium and neodymium isotopes to identify metavolcanic stone sources set the lithic sourcing study in motion. A significant conclusion of that study was the importance of using multiple analytical methods to assign artifacts to specific source locations, and those methods were modeled for the present study.

The pottery sourcing project described in this volume was supported by several institutions involving many participants. It was funded by the Department of Defense and contracted through the Army Corps of Engineers Construction Research Engineering Laboratory, supervised by Mike Hargrave (and formerly by Tad Britt), and by Jeff Irwin, Program Manager, Cultural Resources Management Program at Fort Bragg. Contractual arrangements with consultants were managed by Paul Webb, Regional Manager, TRC Environmental, Inc., who also provided valuable editorial assistance. A number of scholars were recruited for their expertise and skills: Mike Glascock and Jeff Speakman of the University of Missouri for their expertise in element geochemistry and archaeological sourcing, Michael Smith of the University of North Carolina Wilmington for his knowledge of ceramic petrography, and Paul Schroeder and Sheldon Skaggs of the University of Georgia for their expertise in X-ray diffraction. Theresa McReynolds was brought into the project for her background in both archaeology and geology. The research was designed and implemented by the editors, with Vin Steponaitis at the University of North Carolina at Chapel Hill acting in an advisory capacity.

Prior to beginning this research, it was known that some pottery found on Sandhills sites contained crushed rock that originated in the Piedmont. With this knowledge serving as the starting point of exploration, we posed these questions: if some pottery was being transported into the Sandhills from Piedmont locations, then how common was the practice, and where were the original sources? To address these questions, it was necessary to characterize both pottery and clays found in the Sandhills and surrounding regions. As a result of this study, it may now be asserted with confidence that pottery vessels were being transported into the Sandhills from both Piedmont and Coastal Plain sources on a regular basis. Significantly, results indicate that the quality of clay necessary for making pots is not at all common in the Sandhills. In fact, clay of pottery-making quality was difficult to find in every region surveyed, including the Piedmont and lower Coastal Plain. The implication of this finding for modeling resource procurement strategies in a Woodland-period economy is that scheduling visits to resource areas with good clay would be a high priority, perhaps an essential condition for determining the location of settlements. This conclusion is not likely to come as a surprise to modern potters, but may be surprising to many archaeologists who have routinely assumed that pottery clay is ubiquitously distributed across the landscape, perhaps because pottery is everywhere to be found in abundance. One significant achievement of this project therefore is that the results represent an

important first step in dispelling this myth. Also important is the fact that this research demonstrates with some chemical and mineralogical specificity that clay resources in the Carolina Piedmont and Coastal Plain provinces differ in ways that are geologically predictable. The data presented here should therefore be useful in future attempts to determine source areas for pottery found in these regions.

A number of people, other than those previously mentioned, contributed to this project in important ways. Hal Pugh spent a long day visiting clay exposures on Fort Bragg and assessing their quality. Hal and his wife Eleanor Minnock-Pugh were also very gracious in assisting with firing clay test tiles and providing information about matters concerning the assessment of pottery clays. Steve Watts provided assistance in building and firing pots using primitive technologies. Steve Davis, Brett Riggs, and Carl Steen assisted in acquiring pottery samples from key sites in the study area. Dolores Hall was instrumental in obtaining the Archaeological Resources Protection Act permit necessary to collect clays near the Doerschuk site, and Gene Ellis assisted in gaining access to the site. Sandra Bonner aided in the collection of clay samples near the Waccamaw site. Francis Ferrell assisted in securing a Special Gamelands Permit for collecting clay from the shoreline of B. Everett Jordan Lake. Pat Day graciously provided the opportunity to fire test tiles and replica pots. We were surprised and delighted by the interest of so many who contributed to this project, and we pleasantly anticipate future collaborations.

Joseph M. Herbert
Cultural Resources Management Program at Fort Bragg