3-1-2012

From Gizzards to Gastroliths: Early to Mid-Holocene Intensive Harvest and Processing of Migratory Waterfowl at a Carolina Bay in the Upper Coastal Plain of South Carolina

Mark J. Brooks  
*University of South Carolina - Columbia, mjbrooks@mailbox.sc.edu*

Christopher R. Moore  
*University of South Carolina - Columbia, moorecr@mailbox.sc.edu*

Andrew H. Ivester

Follow this and additional works at: [http://scholarcommons.sc.edu/sciaa_staffpub](http://scholarcommons.sc.edu/sciaa_staffpub)

Part of the [Anthropology Commons](http://scholarcommons.sc.edu/sciaa_staffpub)

Publication Info

[http://www.cas.sc.edu/sciaa/](http://www.cas.sc.edu/sciaa/)  
© 2012 by The South Carolina Institute of Archaeology and Anthropology

This Article is brought to you for free and open access by the Archaeology and Anthropology, South Carolina Institute of at Scholar Commons. It has been accepted for inclusion in Faculty & Staff Publications by an authorized administrator of Scholar Commons. For more information, please contact SCHOLARC@mailbox.sc.edu.
From Gizzards to Gastroliths: Early to Mid-Holocene Intensive Harvest and Processing of Migratory Waterfowl at a Carolina Bay in the Upper Coastal Plain of South Carolina

By Mark J. Brooks, Christopher R. Moore, and Andrew H. Ivester

Site 38AK469 is located on the eastern sand rim of Flamingo Bay, a Carolina bay on the U.S. Department of Energy’s Savannah River Site in the Upper Coastal Plain of the Savannah River valley (Fig. 1). Carolina bays are oriented, upland ponds on the Atlantic Coastal Plain from Northeast Florida to New Jersey, with their greatest numbers occurring in the Carolinas and Georgia (Walker and Coleman 1987). Ongoing geoarchaeological investigations at Flamingo Bay have revealed numerous polished gastroliths or gizzard stones in direct association with archaeological material and features associated with Early, Middle, and possibly even Late Archaic occupations. Many of the recovered gastroliths appear as polished pebbles with rounded and polished high surfaces and unpolished low areas or crevices (Figs. 2 and 3). Often, recognizable gastroliths have the appearance of tooth enamel and are visually distinct from the natural pebbles deposited through geologic processes.

Fig. 1: LiDAR digital elevation map of Flamingo Bay and site 38AK469. (SCIAA/SRARP)

Fig. 2: Examples of gastroliths recovered from 38AK469 at Flamingo Bay. Note: Several samples have a “tooth enamel” appearance with rounded and polished high surfaces and dull crevices. (SCIAA/SRARP photo)

Excavations at 38AK469 have revealed numerous Early, Middle, and Late Archaic activity areas with concentrations of utilized flakes and small expedient unifacial tools. Numerous gastroliths have been recovered in association with these artifacts within a sediment matrix composed of carbonized hickory nut, seeds, and small pieces of calcined bone. Analysis of gastroliths and other artifacts (e.g., fire-cracked rock) indicate hearth-related activities, possibly including the preservation of meat through smoking. Some of the gastroliths appear to be of exotic or non-local stone, such as Ridge and Valley chert pebbles, implicating migratory waterfowl. Ethnographic data on processing of birds and smoking of meat by hunter-gatherers may be useful for interpreting the assemblage recovered at Flamingo Bay (e.g. Hudson 1976).

Several Early Archaic activity areas, or possibly discrete, small-scale occupations, were identified earlier at 38AK469 through systematic, close-interval testing (Brooks and Taylor 2003). All shovel tests were conducted on a 10-meter grid, subsequently reduced to five meters, and consisted of 0.50 X 0.50-meter units excavated in five-centimeter arbitrary levels to a depth of 80 centimeters below datum (cmdb). This, and all subsequent work have involved excavation in controlled levels, the processing of all soil through 6.4-millimeter (0.25-inch)
or finer mesh, and the retention of all pebbles. Pebble was retained to provide information about site formation process (i.e., water-lain vs. eolian sedimentation) within the sand rim at Flamingo Bay. These pebbles are reworked and deposited in the bay sand rim from much older geological deposits (i.e., Upland Unit) of probable middle Miocene age (Nystrom et al. 1991). Flamingo Bay formed on, and scoured into, the Upland Unit and has incorporated these pebbles into the sand rim through high-energy shore face processes during high water events.

Serendipitously, while collecting pebbles during the initial work on the current block excavation (2009), small “pebbles” were noticed by Chris Moore that at first looked curiously like tooth enamel. Subsequent lab analysis by Tammy Herron, SRARP Curator, identified these “pebbles” as gastroliths that seemed to be concentrated in the Early Archaic levels. In all cases, gastrolith frequencies peak in higher, predominantly eolian sediments, while naturally occurring, water-lain pebbles occur in higher frequency in deeper levels (near the base of, or below, archaeological deposits).

Spatially, when considering the additional block data (Proveniences 59-63) from 2010, and a reexamination by Herron of the systematic shovel test data for gastroliths, it is clear that intensive bird processing was confined to the block area. Temporally, in addition to Early Archaic bird procurement and processing, the 2010 block data indicate that the intensive activity persisted into the Middle Archaic where there seems to be a strong association between gastroliths, pit features (7,275+/-39—7,456+/-30 cal BP on hickory nut charcoal), and hickory nut charcoal (See discussion of radiocarbon dates from Flamingo Bay on pages 16-21). The latter possibly indicates mass processing and meat preservation through smoking (e.g. Hudson 1976). During the 2011 field season, calcined bone fragments were recovered sufficiently preserved to be identified by Tom Whyte (Appalachian State University, pers. comm., July 25, 2011) as “large bird.” The gastroliths associated with calcined bird bone indicate that processing of waterfowl may also have continued into the Late Archaic. Sparse Woodland and Mississippian components are represented in the plow zone, but the dearth of gastroliths indicates that this was not a major activity. Beyond tool replacement activities, little can be said about the Clovis component at this time.

As noted in Moore et al. (2010), the size of the gastroliths (some exceeding 10 millimeters in maximum length) and the ecological setting implicate migratory waterfowl in the goose/swan/crane size range; however, turkey cannot be entirely ruled out (Dean Harrington, SC Department of Natural Resources, pers. comm., Oct. 21, 2010; Hudson 1976). Also, because only the upper size range of gastroliths is retained on the 6.4-millimeter mesh, and smaller gastroliths have been recovered using 3.2-millimeter (0.125-inch) mesh and flotation sampling, we cannot preclude the possibility that smaller birds were procured and processed as well. Conversely, our comparative data (e.g., the modern turkeys; see below) indicate that large birds also ingest sediments in the sand and grit size ranges.

A number of initiatives were implemented starting in 2009 to obtain more conclusive evidence from the gastroliths as to the target specie(s). Although there is a large body of information on bird gastroliths, there is surprisingly little quantified data relating gastrolith size to bird specie, beyond the general recognition that within the constraints of sediment availability, larger birds tend to ingest larger stones. Thus, seeing the necessity of collecting comparative data, we obtained nine gizzards from modern wild turkeys killed in Edgefield County, South Carolina, courtesy of Robert Abernathy of the Wild Turkey Federation. Also from Edgefield County, Edward Redman contributed five gizzards of various duck species. Thomas Harkins of the SC Department of Natural Resources contributed 24 duck gizzards of various species harvested on the Bonneau Ferry Wildlife Management Area (BFWMA) near Moncks Corner, South Carolina. Thus far, four of the BFWMA
duck gizzards and all of the Edgefield County turkey and duck gizzards have been processed. Unfortunately, large waterfowl are not yet represented in our comparative collection. As expected, preliminary examination of the gastroliths we extracted from the obtained gizzards shows that only the turkey gastroliths approach the size of our largest archaeological specimens (Figs. 4-5). All of the ducks, being much smaller birds, have gastroliths in the sand to grit size range.

Another aspect of our 2011 gastrolith comparative analysis initiative started with Brooks examining all of the pebbles from the 2009 and 2010 field seasons (Block Excavation Proveniences 55-63) and pulling any additional pebbles that are plausibly gastroliths. Particular attention was paid to non-quartz, “exotic” pebbles that might be non-local and, therefore, potentially indicative of migratory waterfowl. This accomplished, the gastroliths and “probable” gastroliths are currently being analyzed, with provenience, level, quad, raw material (mineralogy), maximum length (millimeter), maximum width (millimeter), and weight (gram) being recorded. Concurrently, samples were sent to Andrew Ivester (Department of Geosciences, University of West Georgia), for SEM (Scanning Electron Microscope) analyses, with the comparative samples consisting of five prehistoric gastroliths, five modern turkey gastroliths, five “exotic” gastroliths, and five, presumably local, quartz pebbles from below the archaeological levels (e.g., Fig. 6). Although preliminary, it does look like there may be some “exotic” or non-local gastroliths represented. That said, given the Piedmont-Mountain source area for the predominantly fluvial-derived Upland Unit, what is geologically “local” for that vast source area has yet to be definitively determined. Future research will entail more detailed mineralogical analyses of these and other samples.

Again, serendipitously, while conducting the preliminary SEM analysis, Ivester observed:

On the surface of the modern turkey gastroliths, there is a good bit of organic matter in the low points and in crevices and pits, verified with a high carbon spectral peak. And on several prehistoric gastroliths there is also organic matter in the low pits and crevices—we verified this also by the high carbon peak in spectra from these pits. The carbon shows up as dark spots on the back-scattered electron images. I’m thinking at this point that the organic matter has survived there since prehistoric times—I don’t see how organic matter would accumulate there post-depositionally. So it’s possible that the presence of organic...
matter in pits may be a good identifier for gastroliths (Andrew Ivester 2011, elec. comm.).

The discovery and future analyses of the organic residues apparently associated with the gastroliths fits nicely with other analyses of organic chemistry being contemplated. The oily or greasy nature of waterfowl makes them particularly amenable to preserving through smoking because the flesh does not dry out so readily as lean meat. If the birds were smoked on racks, as is traditionally done, then the grease would drip down into the fire. These fats could potentially be sequestered in the hickory nut charcoal being used for smoking and in the fine or clay fraction of the sediments.

Based on a conversation with Gary Mills (pers. comm., July 12, 2010), an organic chemist with the University of Georgia’s Savannah River Ecology Laboratory, there is the potential for deriving charcoal signatures for slow combustion (smoking) vs. fast combustion (fuel), as well as for extracting glycerides from fat residues that may provide information on diet. Thus, organic chemistry and isotopic analyses may be the key for determining whether or not smoking was a component of the bird processing at 38AK469, and whether the target resource was turkey or large migratory waterfowl. In any case, the recognition of gastroliths (an often ignored or overlooked “artifact”) in archaeological assemblages provides a rare and unexpected insight into the diverse food procurement strategies of Early Holocene hunter-gatherers occupying Carolina bay sand rims and suggests that our traditional sampling strategies for archaeological sites may be missing an important class of data (e.g., Jones 2009) Clearly, we must move beyond “arrowheads and potsherds” to address such issues.

Fig. 6: Optical and scanning electron microscope (SEM) images of a prehistoric gastrolith (Prov. 56G) from 38AK469. (A) Low power optical image, (B) 50x SEM image, (C) 500x high point SEM image, (D) 500x low point SEM image. Note: organic carbon appears as dark spots within small crevices on the surface of the gastrolith (image D). (SCIAA/SRARP photo)

References
Brooks, M. J., and B. E. Taylor

Hudson, C.
1976 The Southeastern Indians. The University of Tennessee Press, Knoxville.

Jones, S.
2009 Gastroliths: The Neglected Artifact. Manuscript on File at the University of Georgia Archaeology Laboratory, Athens, GA.

Moore, C. R., M. J. Brooks, A. H. Ivester, and T. A. Ferguson

Nystrom, P. G., Jr., R. H. Willoughby, and L. K. Price

Walker, H. J., and J. M. Coleman