South Carolina Antiquities

2019 Officers of the Archaeological Society of South Carolina

President:	Keith Stephenson	dksteph@mailbox.sc.edu
Vice President:	David Gordon	dsgordon@hargray.com
Secretary:	Rebecca Shepherd	rshepherd10@gmail.com
Treasurer:	Ashley Stewart	ashleymcintyre1@gmail.com
Journal Editor:	Joseph Wilkinson	jwilkinson.usc17@gmail.com
Newsletter Editor:	Keely Schroer	kschroer@scdah.sc.gov
Archivist:	Brent Burgin	wbburgin@mailbox.sc.edu

Members At-Large

Kelly Higgins, Jessica Cooper, Bach Pham, Savannah Hulon

Past President

Chan Funk

Information For Subscribers

South Carolina Antiquities is published annually by the Archaeological Society of South Carolina. Subscription is by membership in the Society. Annual dues are $25 for individual members, $15 for student and senior members, $30 for family, $25 for senior family, and $100 for institutional members. Life membership is $500. In addition to *South Carolina Antiquities*, members receive the bimonthly newsletter *Features and Profiles*. Membership requests, dues, and change of address requests should be sent via email to archaeologysocietysc@gmail.com, or by mail to ASSC, PO Box 1357 Columbia, SC 29202.

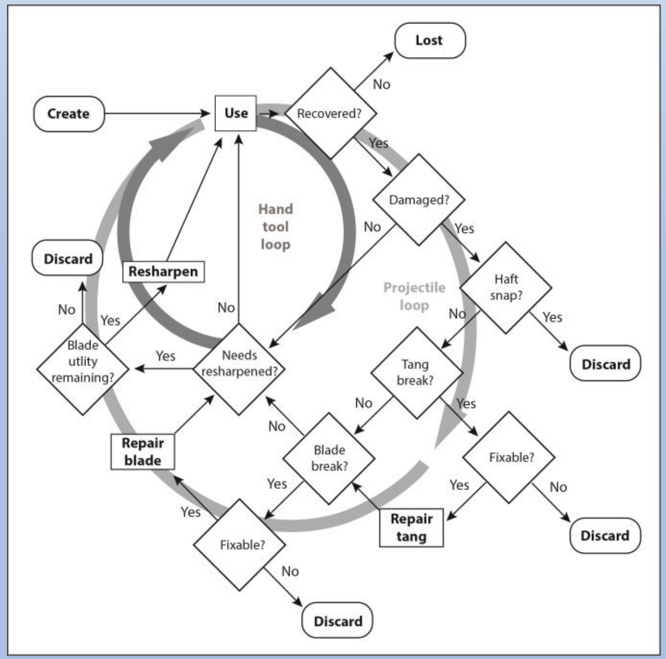
Information For Authors

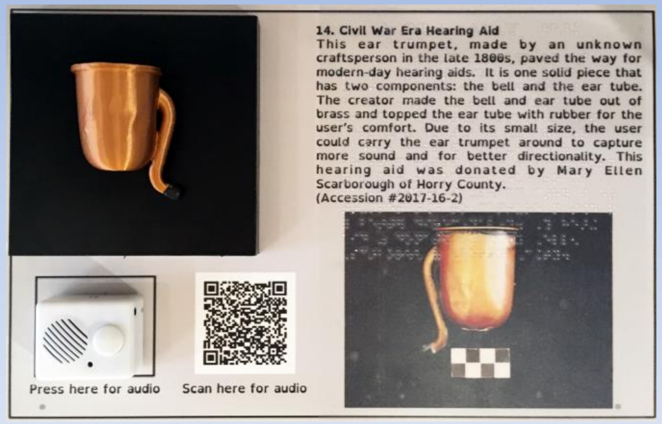
The *Archaeological Society of South Carolina* publishes papers on the prehistoric and historic archaeology of South Carolina and adjacent states. Manuscripts submitted for publication are subject to peer review. The manuscript should be submitted to the Editor in electronic format using MS Word. Illustrations should consist of either high quality prints or scans with a minimum resolution of 300 dpi. Style should conform to the guidelines published in *American Antiquity* (revised 2018).

South Carolina Antiquities Volume 51 2019

South Carolina Antiquities

The Journal of the Archaeological Society of South Carolina





Contributed Papers Concerning the Archaeology of South Carolina and Adjacent States *Volume 51 | 2019*

South Carolina Antiquities

Volume 51

Joseph E. Wilkinson, Journal Editor

Contents

Letter From The Editor

Joseph E. Wilkinson

As our Society enters a new decade, I am honored to serve as the newest editor. My predecessor Christopher Moore set a very high bar with many improvements to our journal, and I hope to continue to uphold the high standard he set. The previous fifty years of our Society has been filled with many enthusiastic and curious individuals who have consistently contributed to our journal, filling it with new insights and discoveries of the archaeological record. I hope this continues as our Society strives towards another fifty years.

This volume, like many before it, is filled with papers that provide new insight into various aspects of the archaeological record in South Carolina. Topics range from Early Archaic lithic studies to educational outreach, and all provide insights into the archaeological record and how we are able to interact with and learn from it. Our Society has historically been very inclusive, having formed and successfully thrived on the cooperative interactions between professional and avocational archaeologists, as well as interested members of the public. These articles reflect this success in one way or another.

I want to thank my predecessor for his many contributions to the Society through his service as editor, and for always being available to answer questions and provide guidance. And to all who have contributed to this edition, I thank you.

A Comparison of Functional Variability Among Early Archaic Notched Points from the Lower Savannah River

Andrew A. White

Early Archaic (ca. 11,500-9000 cal YBP) sites with intact cultural deposits are relatively rare in the Eastern Woodlands. As a result, many of our inferences about the mobility, organization, and demography of the Early Archaic peoples of this region rely heavily on the study of hafted bifaces (bifacially flaked stone tools that were hafted to facilitate use). The broad characterization that Early Archaic societies across the Eastern Woodlands were organized into small, dispersed, highly mobile bands that practiced a generalized foraging economy is based largely on studies of the spatial distributions, raw materials, and attributes of these tools (e.g., Adovasio and Carr 2009; Anderson and Hanson 1988; Bridgman Sweeney 2013; Cantin 2000; Daniel 1998; 2001; Ellis et al. 1998; Meredith 2011; Munson 1986; Stafford 1994; White 2014).

While some Early Archaic tools may have been used solely as the points of projectile weapons, many were undoubtedly also utilized as knives, saws, and/or scrapers. For simplicity and following convention, I refer to this general class of tools as "projectile points" or simply "points" in this paper. The use of these terms does not imply that these tools were used exclusively as projectile tips.

Early Archaic side notched points in the Savannah Valley are generally subsumed under the type designation "Taylor." These points have a distribution centered in the Santee and Savannah River basins in South Carolina and Georgia (see Bridgman Sweeny 2013; Charles and Moore 2018; Michie 1966). As originally defined by Michie (1966), Taylor points have squared ears and slightly concave basal edges. Attributes such as basal grinding, blade edge serration, and alternate beveling of the blade edges occur in varying frequency (Michie 1966).

While Taylor points have yet to be firmly associated with radiocarbon dates in this region, they appear to be part of a widespread side notched horizon that includes named types such as Bolen in Florida, Big Sandy in the Midsouth, and Thebes cluster points in the Midcontinent (see Bullen 1975; Justice 1987; Kneberg 1956). These early side notched forms generally date to ca. 11,450-10,800 cal YBP (~10,000-9500 RCYBP) (see Faught et al. 2003; Driskell 1996; Sherwood et al. 2004; Stafford and Cantin 2009).

Early Archaic corner notched points in the region are generally subsumed within the Kirk Corner Notched cluster as defined by Justice (1987:71-82). This cluster of points contains a variety of technologically- and stylistically-similar point forms dating to within the period ca. 10,800-9800 cal YBP (~9500-8800 RCYBP) (see Cantin 2000; Chapman 1976; Nolan and Fishel 2009; Stafford and Cantin 2009). Named varieties such as Kirk Corner Notched, Stilwell, Palmer, Charleston, Decatur, and Pine Tree are generally distinguished from one another based on criteria related to haft and blade morphology, basal finishing techniques, and blade resharpening (see discussions in Brookes 1985; Cable 1996; DeRegnaucourt 1992; Justice 1987; Nolan and Fishel 2009; Stafford and Cantin 2009). For the purposes of this paper, the simple term "Kirk" will be applied to all the varieties in this larger family of corner-notched point forms. As with Taylor points, ground basal edges, serration, and blade beveling occur in varying frequency.

Kirk points occur across an immense area extending north-south from the southern Great Lakes to the Florida Peninsula and east-west from the Mississippi corridor to the Atlantic coast. The wide geographic distribution of Kirk points is often referred to as the "Kirk Horizon (see Tuck 1974; see also Coe 1964:122). It is currently unclear how much of the variability within the Kirk cluster can be attributed to change through time. While "small" (i.e., "Palmer") varieties of Kirk are often said to pre-date larger varieties of Kirk (following Coe 1964), it is not clear that this is the case (see Cable

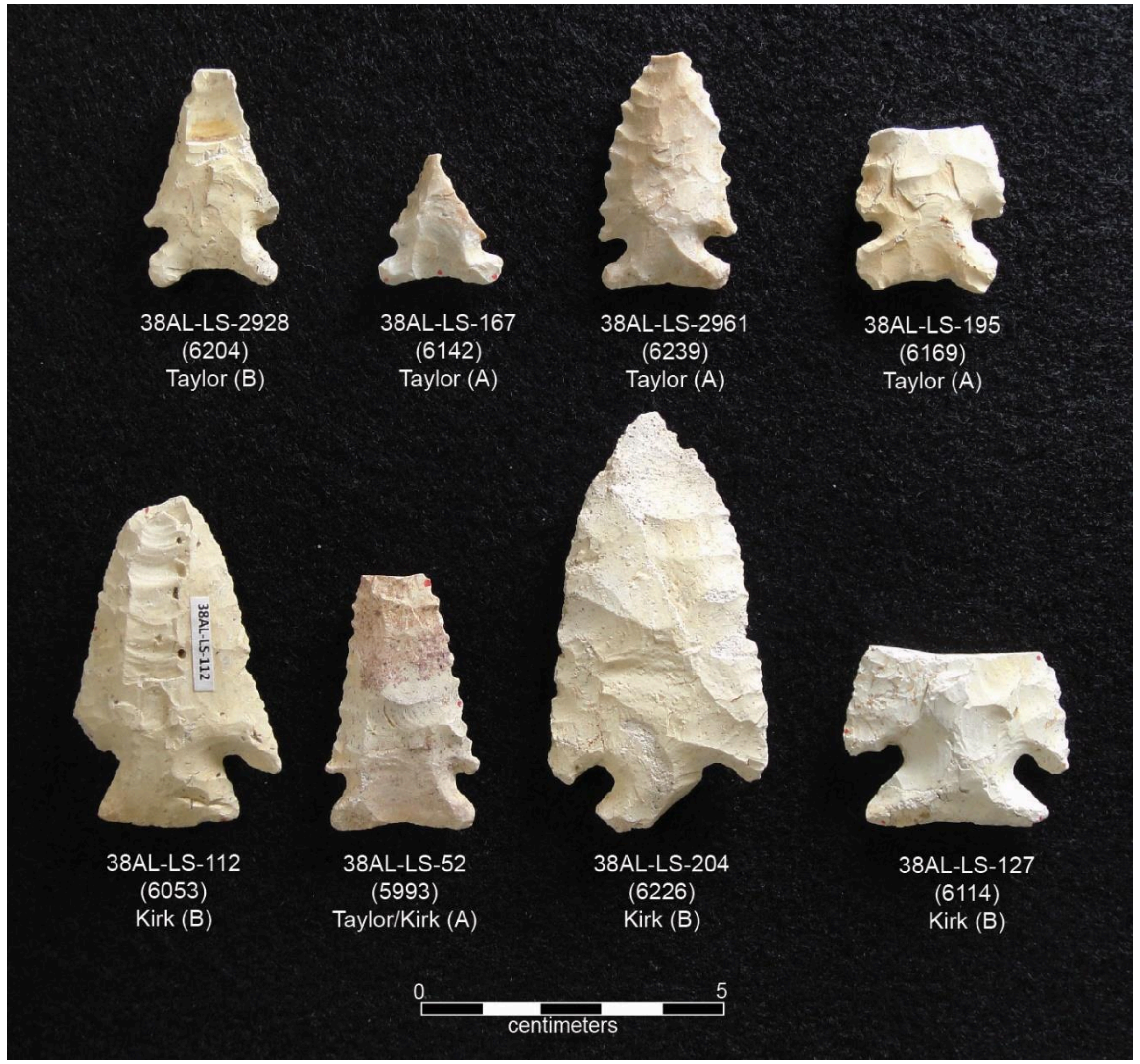


Figure 1:Examples of Early Archaic side and corner notched points in the sample. Numbers in parentheses correspond to ID numbers in the author's database. Group assignments based on notch angle are provided following the type designation.

1996; Sassaman 1996; Sassaman and Anderson 1990).

Most evidence suggests that side notched (Taylor) and corner notched (Kirk) points probably represent roughly sequential periods of time in South Carolina based on date ranges associated with similar point forms in other regions and the presence of apparently unmixed side and corner notched components in good context (see Kimball 1996; Sherwood et al. 2014; Tuck 1974). Stratified sites clearly documenting the temporal precedence of side notched points and a transition from side to corner notching have been elusive, however, and the two point forms have been argued to be contemporary in Florida (Faught et al. 2003). Given that a sequential relationship between side notched and corner notched points appears to be the dominant pattern across much of the east and there is no positive evidence that the two are contemporary in the Savannah River valley, this analysis will proceed under the assumption that side notched (Taylor) and corner notched (Kirk) points comprise a time sequence.

This paper considers macroscopic attributes related to design, use, repair/rejuvenation, and discard in a sample (*n*=200) of Early Archaic side notched and corner notched points from Allendale County, South Carolina. Examples of these points are shown in Figure 1. All of the points were fashioned from Coastal Plain chert. Because all the points in this study were fashioned from the same raw material and collected from the same county, space and raw material are largely factored out of the analysis. This leaves temporal changes in patterns of human behavior as the primary drivers of variation between the side notched and corner notched assemblages considered here.

By comparing several dimensions of functional variability within two large, time-sequential samples of hafted bifaces, this paper seeks to discern patterned similarities and differences in how these tools were designed, used, broken, maintained, and discarded. Individual decisions about the creation and use of these tools certainly articulated closely with fundamental aspects of mobility and subsistence behavior. It is the inter-dependencies among these factors that make the study of Early Archaic hafted biface technologies both useful (in terms of what such studies can tell us about Early Archaic societies) and complex. Available raw material transport data suggest that the scale and/or frequency of residential mobility were somewhat greater among Kirk groups than among the preceding Taylor groups (see Charles and Moore 2018; Wilkinson 2017). Gathering information about patterned functional change among Early Archaic hafted biface technologies allows us to open an aperture through which we can shine light on the workings of those Early Holocene societies and craft explanations of what changed within them, particularly in relation to fundamental questions about the distance, frequency, seasonal rhythms, and strategic underpinnings of their movements across the landscape.

Early Archaic Projectile Point Design, Use, Repair/Rejuvenation, and Discard

Archaeological assemblages of projectile points are the product of multiple, interconnected human behaviors related to the design, manufacture, use, rejuvenation/repair, loss, and discard of these tool components. All of those behaviors are related to *functional variability*, defined here as that part of formal variability connected to the operation of an artifact in the material realm (Kamminga 1982; Sackett 1982). Because functional variability affects the performance or utility of an artifact, it is conditioned by a selective environment in which attributes can be evaluated by the user based on some criterion or criteria of performance (cf. Bleed 1986; Meltzer 1981:314; Schiffer and Skibo 1987, 1997; Shott 1996; White 2008). Trade-offs may influence how a tool performs various aspects of its intended function or functions: a more robust projectile point may be less prone to breakage on impact, for example, but less efficient at cutting/piercing and more difficult to securely haft (e.g., see Bleed 1986; Guthrie 1983). A selective environment constrains functional variability because not all possible combinations of attributes will allow a tool to be used for its intended purpose.

This paper considers eleven attributes/variables that are related to the functional design, use, repair/rejuvenation, and discard of Early Archaic projectile points. Terminology and measurement definitions are provided in Figure 2.

Neck Width and Thickness. The neck of a notched projectile point is the location of greatest constriction of the haft area. The width of the neck tends to correlate with the diameter of the shaft or foreshaft to which the point is attached (see Christenson 1986; Shott 1990, 1997; Thomas 1978). The dimensions of the neck are likely to be constrained somewhat by the dimensions and configuration of the shaft to which it must be attached, especially when points are designed to be interchangeable components of a compound weapon system. The non-lithic parts of such a weapon system (i.e., the shaft and/or foreshaft) are also likely to be relatively standardized and may be highly curated, requiring more effort to produce than the points themselves (Keeley 1982). The dimensions of the neck also affect the strength of the point, with thicker points being more resistant to breakage when loads are applied. Cheshier and Kelly (2006) observed that higher ratios of thickness:length were associated with increased durability (defined as how many times a point could be fired before breaking) of the arrow points in their experiments.

Blade Length. The length of the blade determines the extent of the edge available for cutting/sawing tasks that depend on motion along the longitudinal axis. Other things being equal, long blades are more prone to breakage through bending than short blades. In their experimental study of

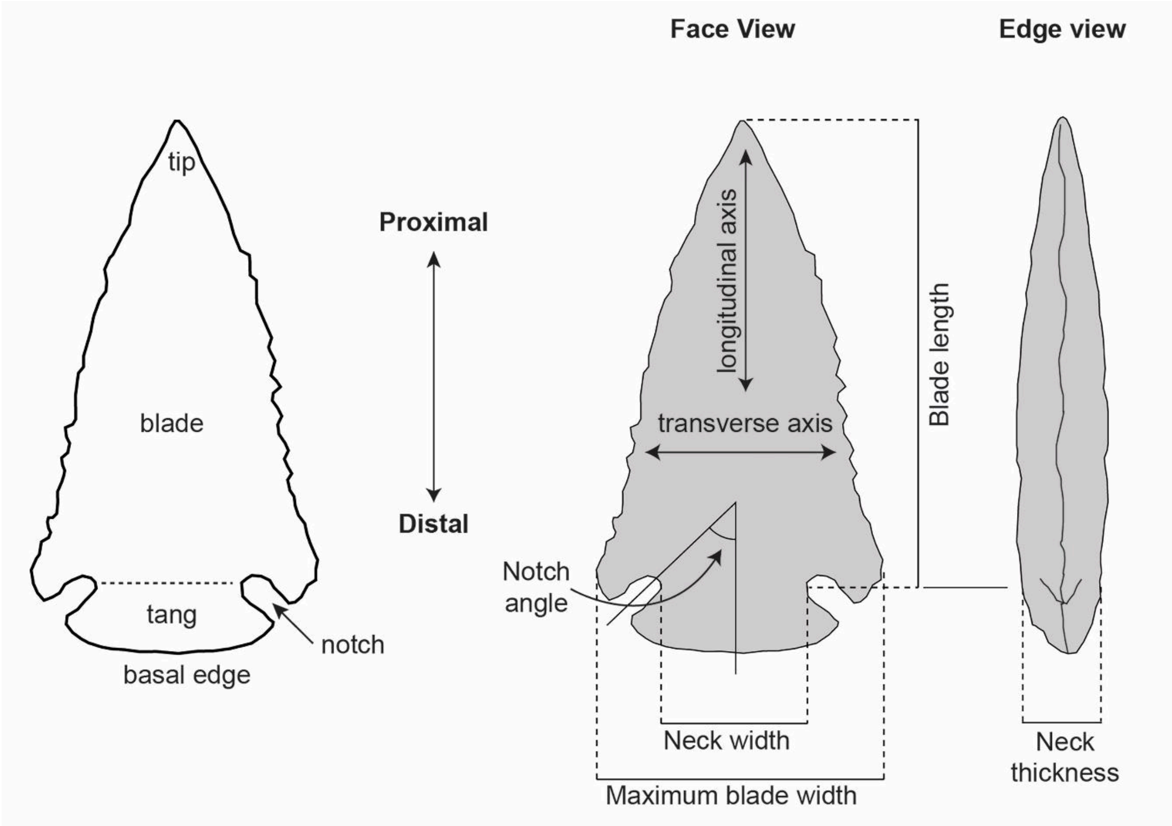


Figure 2: Definitions of terminology and measurements.

arrow points, Cheshier and Kelly (2006) found that arrow points with low ratios of thickness:length were, on average, less durable than points with high thickness:length ratios.

Maximum Blade Width. The blades of unbroken Taylor and Kirk points are generally trianguloid in form. Other things being equal, greater blade width would tend to increase strength along the transverse axis through the addition of mass. Points with narrower blades are presumably more susceptible to breakage than points with wider blades when loads are applied to the edge during activities such as cutting or sawing, simply because narrower blades incorporate less material to resist loads.

Basal Grinding. The haft regions of many Taylor and Kirk points exhibit margins (basal, lateral, and notch interior) that have been intentionally dulled through abrasion. The most common explanation for grinding the haft regions of points is that the smoothed margins served to protect haft lashings from damage while the tools were being used (see Titmus and Woods 1991; Werner 2017). Controlled experiments found no support for the idea that grinding of the lateral margins serves to protect haft lashings (those experiments only replicated use of the tools as projectiles and did not consider motions such as sawing or cutting , however) (Werner 2017). Titmus and Woods (1991) suggest that the dulling of edges may increase the strength of the haft margins and their resistance to bending stresses exerted during use.

Blade Serration. Serrated blade margins are produced by the removal of a sequence of small flakes to produce a jagged, saw-like edge. Compared to a smooth blade edge, a serrated edge has less contact area with material being cut and each point of contact is at a shaper angle relative to the surface being cut, enhancing the cutting capacity of the blade. Presumably, points with serrated edges were intended to function as knives or saws (perhaps not exclusively, but in addition to their roles as projectile points). Examples of points with serrated blade edges are shown in Figure 1 (38AL-LS-2928 and 38AL-LS-52).

Alternate Blade Beveling. Beveled blade edges are common on the Taylor and Kirk points in the sample. Alternately beveled edges are created by the removal of steep flakes from alternate faces of the point, producing a parallelogram-shaped cross-section. The "side" of the bevel is conventionally identified as the side on which the beveled surface is visible when the point is held with the tip pointing up. Taylor and Kirk points are most frequently beveled on the left. All four of the points in the top row of Figure 1 are beveled; in the bottom row, 38AL-LS-52 is beveled and 38AL-LS-204 has a slight twist.

Most researchers attribute beveling to edge-resharpening behavior that is intended to conserve blade length (e.g., see Goodyear 1974; Morse 1997; Sollberger 1971). The occurrence of Taylor and Kirk points with alternately beveled blades of a variety of lengths and widths in consistent with the idea that resharpening by beveling was a progressive phenomenon, occurring sometimes repeatedly during the use-life of a point. In an experimental study, Lipo et al. (2012) found support for the idea that alternate blade beveling contributes to the accuracy of the projectiles to which the points are attached. A review by Pettigrew et al. (2015) concluded that resharpening behavior was the more likely explanation for the alternately beveled points of the Early Archaic period.

Transverse Blade Breakage. Patterns of blade breakage are related to patterns of point use and discard. The locations of blade breaks may provide insights into the directions and magnitudes of loads being applied to the blade when the break occurred. Unrepaired breaks provide insights into decisions about repair vs. discard. Transverse blade breaks can occur as a result of impacts, but can also be produced during other kinds of use (Dockall 1997). Titmus and Woods (1986:43-43) identified bending breaks located at the neck as the most common kind of break produced by impacts. Breaks of the distal portion of the blade also occurred in the impact experiments performed by Titmus and Woods (1986:44).

Longitudinal Blade Macrofracture. Experimental studies have shown that the proximal portions of stone projectile points are commonly damaged during impacts (see Cheshier and Kelly 2006; Dockall 1997; Fisher et al. 1984; Iovita et al. 2012; Titmus and Woods 1986). Longitudinal blade macrofractures, often referred to simply as "impact fractures," are defined as fractures that are initiated by force in the distal region of the blade and travel down one face. Longitudinal blade macrofractures can have either feather or hinge terminations (Dockall 1997; Frison 1974). Examples of this kind of fracture are shown on points 38AL-LS-2928 and 38AL-LS-112 in Figure 1.

Lateral Blade Macrofracture. Lateral blade macrofractures, like longitudinal blade macrofractures, are initiated by a force applied to the distal region of the point. Rather than traveling down one of the faces, however, lateral macrofractures travel down an edge of the blade (i.e., removing portions of both faces and leaving edges with approximately right angles). Lateral blade macrofractures (*aka* shearing fractures) can be caused by high speed impacts (Dockall 1997; Titmus and Woods 1986).

Tang Breakage. This category of break includes any broken edge in the tang area of the point. Experimental studies have shown that impacts can produce a variety of tang breaks (Cheshier and Kelly 2006; Dockall 1997; Titmus and Woods 1986), including lateral macrofractures. In the tang region, lateral macrofractures in the tang region are initiated from the proximal end of the point through contact with the haft. Tang breaks of other kinds could also be produced during high speed impacts as well as other kinds of use. An example of a tang break is shown on point 38AL-LS-204 in Figure 1.

Sample

The sample considered in this paper comprises 200 projectile points from the Larry Strong Collection curated at the University of South Carolina. The Larry Strong Collection was collected by Dr. Larry Strong from the surfaces of numerous sites in Allendale County, South Carolina, over the course of four decades. An estimated 17,000 artifacts from Strong's collection are now curated by the South Carolina Institute of Archaeology and Anthropology. Inventorying of that collection is ongoing, supported by a grant from the

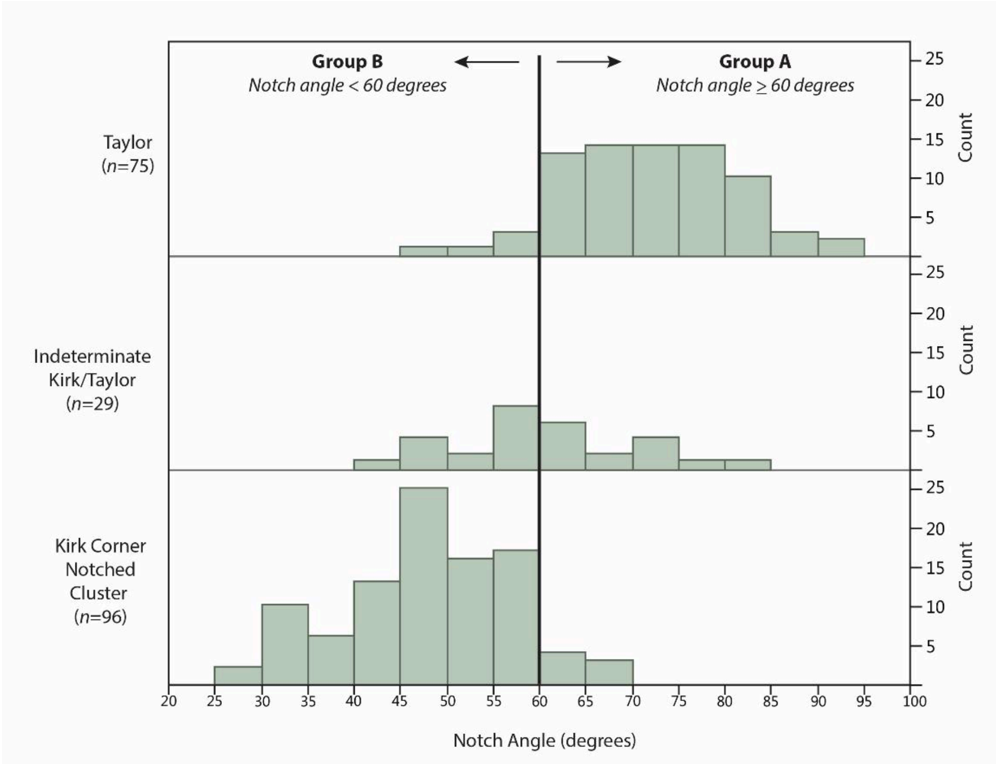


Figure 3: Distribution of notch angle according to type designations; division of sample in Group A and Group B.

Archaeological Research Trust (White 2016a). Approximately 450 of the points inventoried so far fall within the Kirk Corner Notched cluster as defined by Justice (1987:71-81). Approximately 340 points have been identified as having affinities with Taylor. Some of the Kirk points in the Larry Strong collection were analyzed by White (2016b). Many of the Taylor points in the collection were included in Bridgman Sweeny's (2013) work.

All of the points in the sample were produced using Coastal Plain chert, a Tertiary marine chert that outcrops in western South Carolina and central Georgia (Bridgman Sweeney 2013:Figure 3-5; Goodyear 2014; Goodyear and Charles 1984). The most likely source of the Coastal Plain chert used to make the points in the Larry Strong Collection is the vicinity of Allendale County itself, which contains outcrops of Coastal Plain chert known locally as "Allendale" and "Brier Creek" (Goodyear and Charles 1984).

Coastal Plain chert undergoes time-transgressive weathering when exposed to the atmosphere. This weathering affects exposed surfaces and penetrates a short distance into the material, tending to transform the original colors (typically varying from buff to reddish-brown) into a light tan or off-white and coarsening the texture. One advantage of this weathering is that it makes possible to confidently discriminate old breaks from modern ones: the surfaces of fresh breaks typically reveal the unweathered interior material of the point, while the surfaces of ancient breaks are weathered to the same degree as the adjacent surfaces of the original point.

Projectile points were chosen from the Larry Strong Collection for this analysis based on (1) their "fit" somewhere within the continuum of the Taylor and Kirk technologies associated with Early Archaic societies of the lower Savannah River and (2) the absence of modern breaks that would interfere with observation of the portions of the point relevant to this study. Points in the collection were evaluated for the sample in roughly the order they were cataloged, which was not a random sampling strategy. Because earlier analyses of the same collection focused on collecting 3D data from the haft regions of Kirk points (White 2016b), the Kirk sample used here may contain a higher

percentage of points with complete hafts than would be obtained with a random draw from the collection. This should be kept in mind when interpreting data on the frequency of haft breakage.

The morphological overlap between Taylor and Kirk makes it difficult to confidently place some points in one typological group or the other. Notch angle, origination (i.e., whether the notch was executed from the side or the corner of the biface), and overall haft morphology are important factors to discriminate "Kirk" (corner notched) and "Taylor" (side notched) from one another. Because a number of points could not be placed confidently into one of those two groups, notch angle was measured as a continuous variable (see Figure 2). Notch angle was estimated by orienting an image of the point so that the longitudinal axis was vertical, maximizing basal symmetry and minimizing neck width. Photoshop was used to measure the angle created at the intersection of the longitudinal axis and a line extending through the central portion of the notch.

As shown in Figure 3, there is some overlap in notch angle between the points in the sample typed as Taylor (*n*=75) and those placed in the Kirk Corner Notched cluster (*n*=96). Overlap in the distributions occurs between 45 and 75 degrees, which is where the majority of indeterminate points (*n*=29) falls. For the purposes of this analysis, an arbitrary threshold of 60 degrees was used to create two groups. Points with notch angles of 60 degrees or more are placed in Group A; points with notch angles less than 60 degrees are placed in Group B. Group A (*n*=91) includes 70 points classified as Taylor, seven points placed in the Kirk Corner Notched Cluster, and 14 indeterminate points. Group B (*n*=109) includes 89 Kirk points, five Taylor points, and 15 indeterminate points.

If side notched point technologies tend to predate corner notched point technologies during the Early Archaic in this region, as discussed above, Groups A and B can be presumed to comprise "earlier" and "later" assemblages of Early Archaic points in this region. To be clear, that does not mean that every point in Group is presumed to be older than every point in Group B. It means, rather, that it is presumed that the average age of the points in Group A is greater than the average age of the points in Group B.

Analysis

Basic data on metric, non-metric, and breakage attributes are presented in Table 1. All metric data were collected using calipers.

Design Attributes

Two metric attributes – neck width and neck thickness – relate to the form of the point prior to its entry into the use/discard cycle. These attributes would not be expected to change during regular use/maintenance of the point, as the neck region would not be involved in resharpening and a fracture across the neck region would likely result in the discard of the point. Because the width and thickness of the neck are directly implicated in mounting the stone point onto an organic shaft or handle, one would reasonably expect the ranges of these attributes to reflect consideration of the size of the intended haft. Neck width and thickness are also related the strength of that part of the point. Thus these two attributes of size are affected by dual functional considerations, both of which would serve to constrain to the range of variability.

The Group B points are, on average, slightly wider and thicker at the neck than the Group A points. Histograms of these variables (Figure 4) show that these differences can be attributed to a right tail in the Group B distributions. When the neck dimensions are plotted by the typological groupings (Figure 5), it is apparent that Kirk points account for most of the points at the high end of the size continuum. The difference in neck width, though slight, is statistically significant at the $p <$ 0.05 level (p = 0.0053, t =2.82, df = 198). The difference in neck thickness falls just short of the p = 0.05 threshold (p = 0.066, t = 1.848, df = 198).

The coefficient of variation (CV), calculated by dividing the standard deviation by the mean, is a simple statistic for expressing the amount of variability in an attribute relative to the value of the mean (Simpson and Roe 1939; Thomas 1986). The CV allows the relative amounts of variation to be compared among variables with different means. Coefficients of variation for neck width and thickness are low (0.17 and 0.19 for neck width in Groups A and B, respectively, and 0.16 and 0.22 for neck thickness in Groups A and B, respectively), consistent with variables that were constrained by hafting considerations. The CV values for neck width are comparable to those from Thebes and

Table 1: Basic data on metric, non-metric, and breakage attributes.

	Group A			Group B		
Metric Attributes	***n***	**Mean**	**Standard Deviation**	***n***	**Mean**	**Standard Deviation**
Neck Width	91	15.8	2.70	109	17.0	3.22
Neck Thickness	91	5.6	0.92	109	5.9	1.30
Blade Length	91	25.9	8.68	109	29.3	1.60
Maximum Blade Width	87	22.1	4.64	103	29.9	7.64

Non-Metric Attributes	***n***	**Present**	**Absent**	**Indeter.**	***n***	**Present**	**Absent**	**Indeter.**
Basal Grinding	91	74	16	1	109	80	28	1
Serration	91	40	48	3	109	34	72	3
Blade Beveling	91	71	19	1	109	49	57	3

Breakage Attributes	***n***	**Present**	**Absent**	**Indeter.**	***n***	**Present**	**Absent**	**Indeter.**
Transverse Blade Break	91	62	29	0	109	65	44	0
Long. Blade Macrofracture	91	8	83	0	109	10	99	0
Lat. Blade Macrofracture	91	1	90	0	109	5	104	0
Tang Break	91	23	68	0	109	15	94	0

Table 2: Comparison of frequencies of basal grinding, blade serration, and blade beveling in Groups A and B.

Attribute	**Frequency Present (%)**		**Chi-squared**	***p***
	Group A	**Group B**		
Basal Grinding	82.2	74.1	1.886	0.170
Blade Serration	45.5	32.1	3.648	0.056
Blade Beveling	78.9	46.2	21.873	***<0.00001***

Table 3: Comparison of breakage frequencies in Groups A and B.

Attribute	**Frequency Present (%)**		**Chi-squared**	***p***
	Group A	**Group B**		
Transverse Blade Break	68.1	59.6	1.546	0.214
Longitudinal Blade Macrofracture	8.8	9.2	0.009	0.925
Lateral Blade Macrofracture	1.1	4.6	2.074	0.150
Tang Break	25.3	13.8	4.272	***0.039***

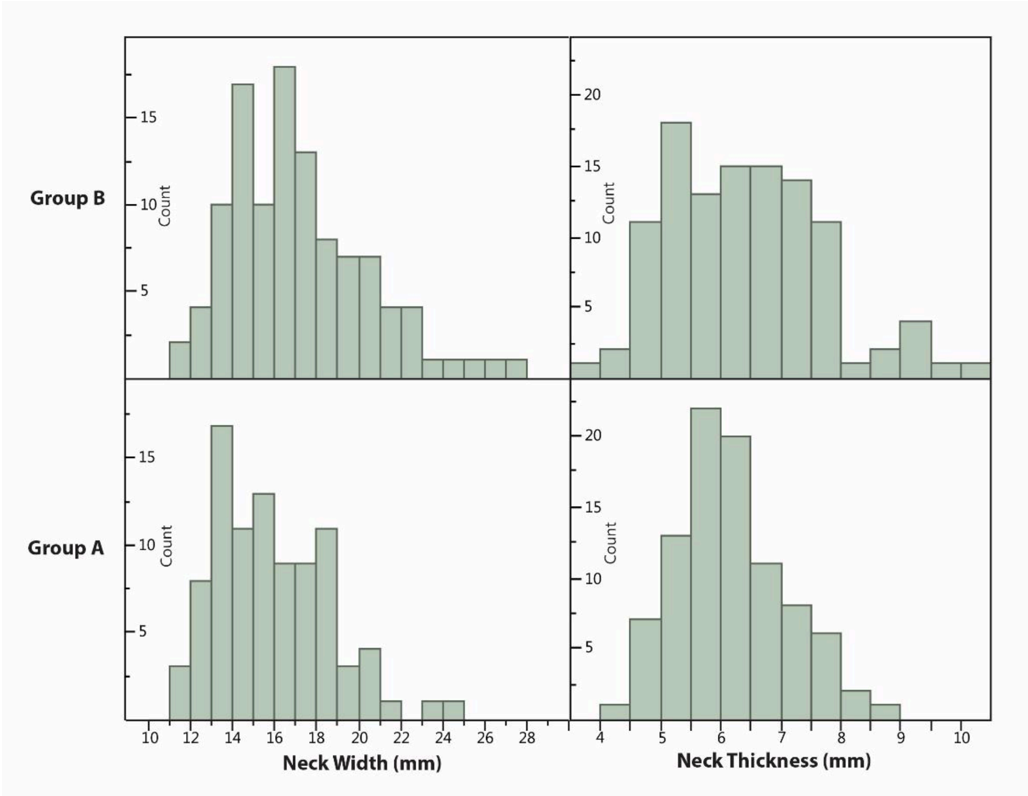


Figure 4: Histograms of neck width and thickness in Group A and Group B.

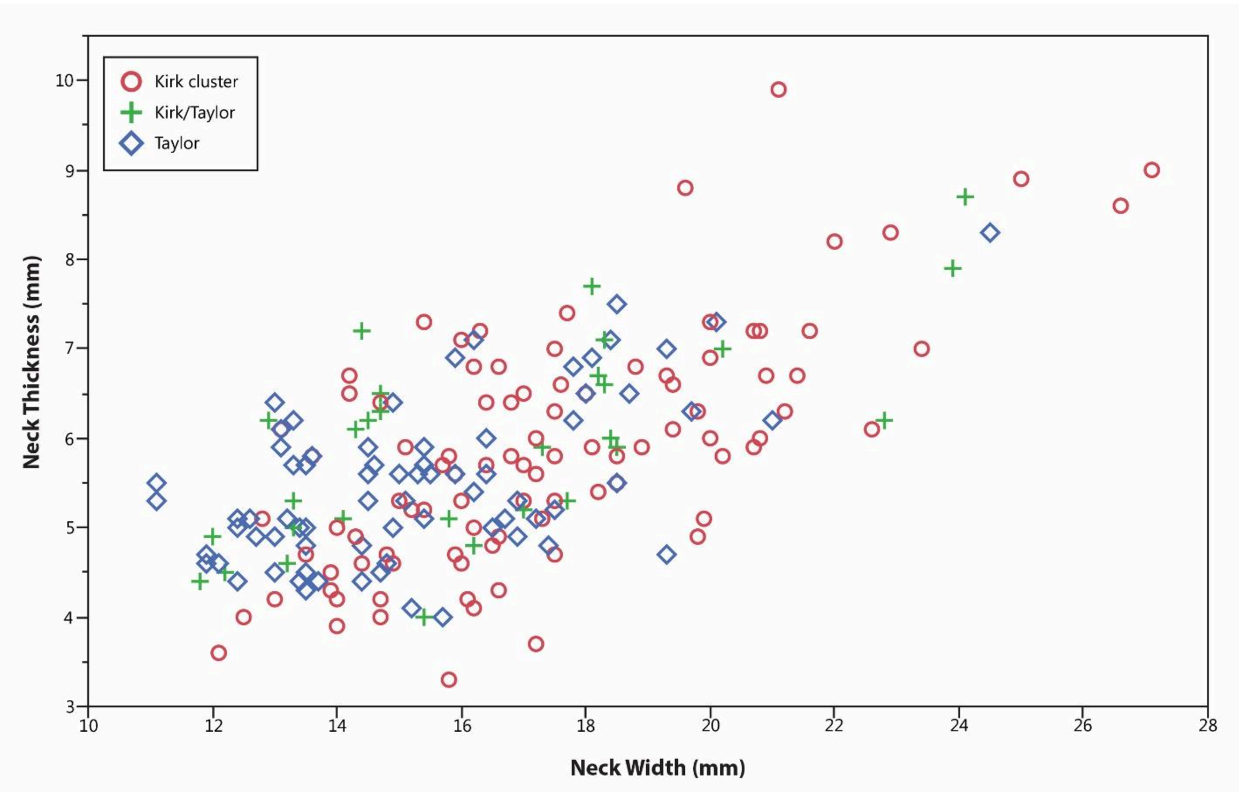


Figure 5: Neck width plotted against neck thickness.

Kirk points from the Midcontinent (White 2012). The larger CV values associated with Group B are presumably related to the presence of "large" Kirk points in Group B.

Finishing and Rejuvenation Attributes

Basal grinding, blade serration, and blade beveling are commonly observed attributes of Early Archaic hafted biface technologies. While these characteristics are present in both Group A and Group B, their frequencies differ (Table 2). All three characteristics are more prevalent in Group A. In only one case, however – that of blade beveling – is the difference statistically significant at the p = 0.05 level. The differences in finishing and rejuvenation attributes between Group A and Group B are concordant with the general observation that the frequencies of basal grinding, serration, and beveling are high among the earliest Early Archaic point technologies and tend to decrease through time.

Breakage and Blade Dimensions

In general, breaks are common on both the blades and tangs of the points in the sample. Four different classes of breaks were recorded: transverse blade breaks, longitudinal blade macrofractures, lateral blade macrofractures, and breaks in the tang region. Fractures of the blade are present in similar frequencies in the two groups (Table 3). Tang breaks are more common in Group A, and the difference is statistically significant.

A note of caution is in order when considering the significance of the difference in tang breaks. Given that the Group B sample contains many Kirk points that were selected from the larger collection because the haft regions appeared to be relatively complete (i.e., for the analysis reported by White 2016a), tang breaks may be under-represented in Group B relative to their actual occurrence in the sample universe.

Longitudinal and lateral blade macrofractures – often considered the best macroscopically-observable evidence of the use of points as projectiles – are present in low frequencies in both groups. Transverse blade breaks, which could have been caused by high speed impacts, other kinds of use, and possibly resharpening, are present in much higher frequencies.

In the sample considered here, breaks coded as "transverse blade breaks" ranged from small fractures that removed a small portion of the tip of the blade, to snaps that occurred near the middle of the blade, to failures that removed most of the blade including one or both shoulders. To look for patterning in the placement of breaks, the width of the remaining blade at the location of the fracture was recorded. Given that the blades of these points tend to be triangular in shape, they are narrower in width near the tip and broader near the shoulders. Figure 6 shows the distribution of blade width at the location of blade breaks. The distribution in Group B is wider, suggesting that both small tip fractures and major failures nearer the shoulders of the blade are more common than in Group A. In both groups, however, transverse blade breaks occur in all regions of the blade.

Design, Use, and Discard Patterns

In terms of the design considerations revealed by the neck dimensions, the Group A and Group B points are similar. Group B points are slightly wider and thicker on average at the neck. This may be due to the inclusion of several large Kirk Corner Notched points in that group. It is worth noting that significant variability in size is often associated with the broader Kirk Corner Notched cluster, and the existence of "large" and "small" varieties of Kirk has been noted for a long time (see Justice 1987). As discussed above, it remains unclear whether these different size classes of Kirk points have temporal significance. In terms of function, however, it seems reasonable that "large" and "small" Kirk points may have been created with different sets of tasks in mind. Given that all the points in the sample are made from Coastal Plain chert, the size range cannot be attributed to constraints imposed by different raw materials.

Whatever the case may be, it appears that large Taylor points are not present in the sample in the same proportions as large Kirk points. There are two possible behavioral explanations for this difference: (1) large Taylor points may not have been created in the same proportions as large Kirk points; and/or (2) large Taylor points may not have been discarded in the same frequency as large Kirk points in the geographic area from which the sample was drawn. It also possible that large Taylor points are present in the larger collection

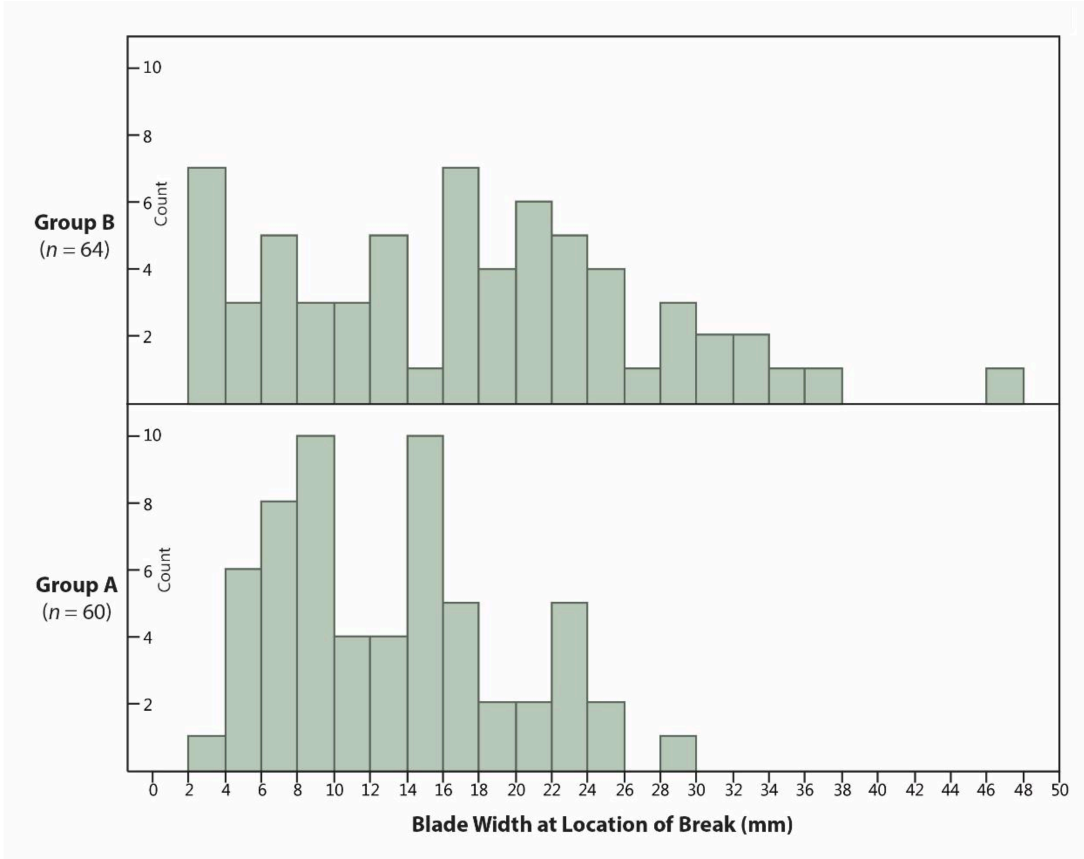


Figure 6: Histograms of blade width at the location of a transverse blade break.

from the area but are simply under-represented in the portion of the collection that is in the possession of SCIAA. Further work will be required to discriminate between these possibilities.

Basal grinding and blade serration are present in lower frequencies in Group B. While the differences are not statistically significant, they are concordant with the general observation that those finishing characteristics tend to be more common earlier in the Early Archaic.

The difference in the prevalence of beveling is not due to chance, and reflects a greater use of this resharpening technique earlier in the Early Archaic period. It is worth pointing out, however, that almost half of the Group B points (the majority of which are typologically Kirk) have beveled blades. This is a higher incidence of beveling than is often attributed to Kirk. Among the 120 beveled points in the sample, all but two have a left-hand bevel (one has a right-hand bevel and one is beveled bi-laterally).

The idea that beveling serves to maintain blade length during multiple episodes of resharpening is supported by a comparison of the ratio of blade length to maximum blade width among the beveled and unbeveled points with unbroken blades (Figure 7). Points with beveled blade edges clearly tend to be longer relative to width than those with unbeveled blade edges. The difference in the means is statistically significant at the p = 0.05 level ($p < 0.0001$, $t = 10.9432$, $df = 68$).

Presuming for the purposes of this analysis that the large majority of the points in the sample were intentionally discarded (i.e., rather than lost during use), the distributions of blade length and breaks provides evidence of how Early Archaic peoples were making decisions about repair and rejuvenation of points prior to discard. Each time a point is damaged or used to the point of requiring rejuvenation, the owner would have made a decision to either repair/rejuvenate the point or discard it. That decision would likely have been based on a number of factors, including the "utility" potentially remaining in the point subsequent to repair/rejuvenation and the costs of making a new point as a replacement. If the amount/location of damage was such that the point could not be returned to a functional state through repair, the point presumably would have been discarded 100 percent of the time (or possibly transformed into some other form of tool). If a blade or a tang break could be repaired to return the tool to a functional state, presumably such a repair would be made if the utility remaining in the tool outweighed the costs of replacement.

Figure 8 illustrates the distributions of blade length among points with both broken and unbroken blades and broken and unbroken tangs. There are wide distributions of blade length among both broken and unbroken blades. Blade breaks significantly outnumber tang breaks.

The distributions of blade length among unbroken points (i.e., points with neither blade nor tang breaks) provide information about discard vs. repair/rejuvenation decisions that were presumably based on the utility remaining in the blade. The distributions differ between Group A and Group B, with Group A (n = 20) having a smaller range and a lower mean remaining blade length than Group B (n = 38) (24.9 mm in Group A vs. 33.1 mm in Group B). The difference is statistically significant at the p=0.05 level (p = 0.0002; t = 3.9888; df = 56). The shorter blade length of unbroken Group A points relative to Group B suggests a more conservative strategy that emphasized the careful maintenance and intensive use of the points, consistent with the higher incidence of bevel resharpening in Group A.

The blade length ranges of the unbroken points suggest that even very short points retained some utility in these Early Archaic technological systems. The sample contains no unbroken Group A points with blades longer than 34 mm: such points evidently retained some utility and would not have been discarded until that utility was "used up." That threshold seems to be higher in Group B, with no points with complete blades longer than 53 mm. The distributions of blade length among the unbroken points also suggests that Group A points were retained for use with less blade length remaining than points in Group B.

It is noteworthy that the points with the longest blades in both groups are those with tang breaks. This suggests that a tang break could result in the point being discarded even when blade length was still relatively long. Presumably this would have been because the broken tang made it difficult or

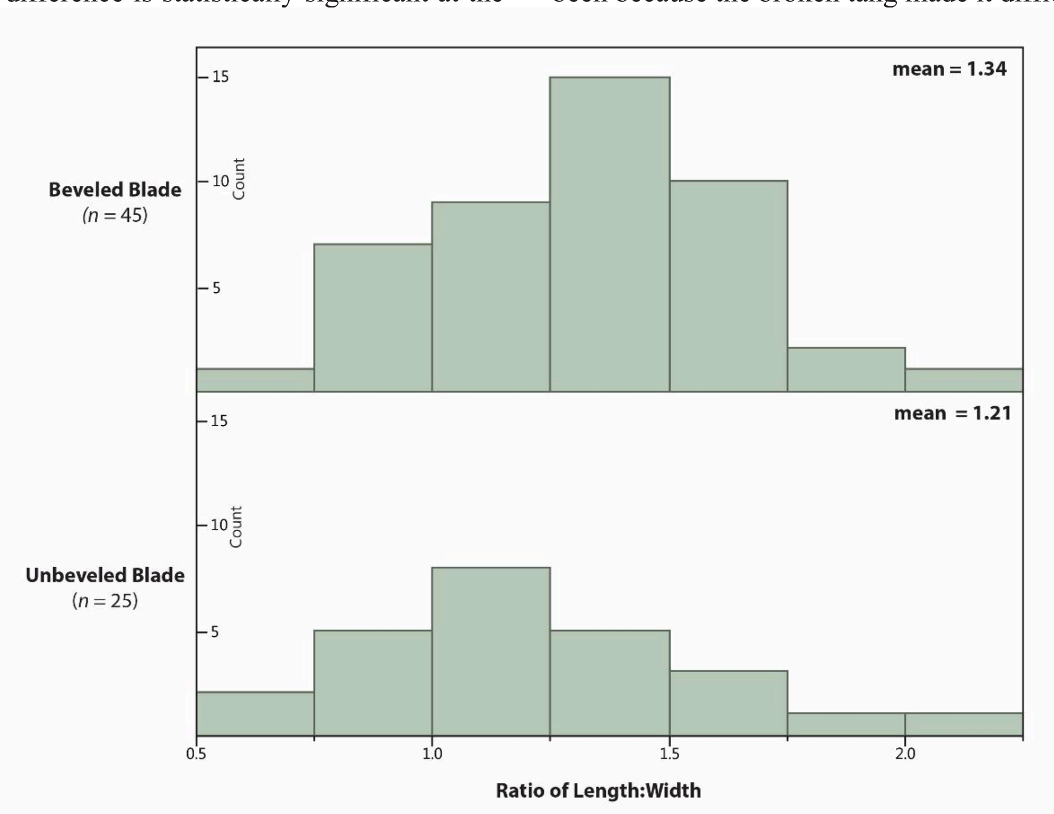


Figure 7: Distributions of the ratios of length:width among points with beveled and unbeveled blades.

impossible to mount the point properly in the shaft and continue using it for its intended functions.

Points with broken blades were discarded at higher rates than those with unbroken blades. Depending on the location of the break, some points would have been repairable and others not. As shown above, the locations of blade breaks were variable, ranging from small tip fractures to major failures near the shoulders. Breaks that could be characterized as "major failures" – leaving very little blade length left to work with -- were more common among Group B points.

Discussion

The points considered in this study are single components of compound tool systems that were used by Early Archaic peoples in a specific region of the Eastern Woodlands. Changes in how these tools were used, then, have implications for changes in the characteristics of the technological systems in which these tools were embedded, therefore, implications for changes in the behavior of Early Archaic peoples employing those technological systems.

Figure 9 presents a general conceptual model of processes related to the use and discard of Early Archaic chipped stone projectile points. This model captures both the general linearity of projectile point use-lives (i.e., there is a moment at which a tool is created, a period of time during which a tool is used, and a moment of discard or loss at which a tool ceases to be used) and the cycles of use and repair/rejuvenation which are potentially embedded within that linearity. The model incorporates two general "loops" of breakage, repair, and rejuvenation depending on whether an individual use event was as a hand tool or as a projectile. The model and the discussion presented below assumes that the points in the sample considered here were acceptable as created (i.e., they are not manufacturing failures) and that modification or loss subsequent to creation was related to use.

The high incidence of fractures in the sample is consistent with the idea that the use of these tools as projectile points was common. As made clear by numerous experimental studies (e.g., Cheshier and Kelly 2006; Titmus and Woods 1986:43) stone hafted bifaces are fragile objects when employed as projectiles: many break on the first impact and few survive multiple impacts. While the incidence of what are usually regarded as definitive "impact fractures" (i.e., longitudinal blade macrofractures) is low in both groups, it is clear that impacts produce multiple kinds of fractures in both the blade and the tang region (and a single impact can produce multiple fractures).

Presuming that most breaks are caused by projectile use, there is nothing in the data to suggest that there were significant differences between the earlier (Group A) and later (Group B) use of these tools as projectile points: both groups show a high number of breaks. As discussed above, the one statistically significant difference in breakage patterns (the occurrence of a lower-than-expected number of tang breaks in Group B) could be due to issues with the sample.

Experimental studies of stone projectiles show that breaks are often catastrophic, with no real chance for repair (see Cheshier and Kelly 2006:357; Titmus and Woods 1986). In the sample considered here, it appears that breaks of the tang and/or the blade often caused the discard of a point. The longest points in both Group A and Group B are those with broken tangs, suggesting that a break in the tang region was sufficient reason to discard a point even when significant blade length remained. This probably reflects the necessity of the haft region being substantially intact in order for a tool to be hafted securely and function in its intended tasks. While blade edges and tips can often be repaired by removing mass to refresh the point or edge, there was often no way to repair a significant fracture in the haft region. Small breaks of the ears could probably be accommodated, however, as well as minor fractures of the basal edge. Repairs of the basal edges of these points may be responsible for the large degree of non-temporal variability in the basal edge shapes of the Kirk sample described by White (2016b).

There do appear to be significant differences between Group A and Group B regarding decisions made about the repair/rejuvenation of broken points. Group A points were more often discarded with less blade length remaining, and were more often resharpened using an alternate beveling technique. Together, this suggests a greater emphasis on the conservation of blade length, and perhaps on the tools themselves. It seems likely that this aspect of the Group A points (most of which

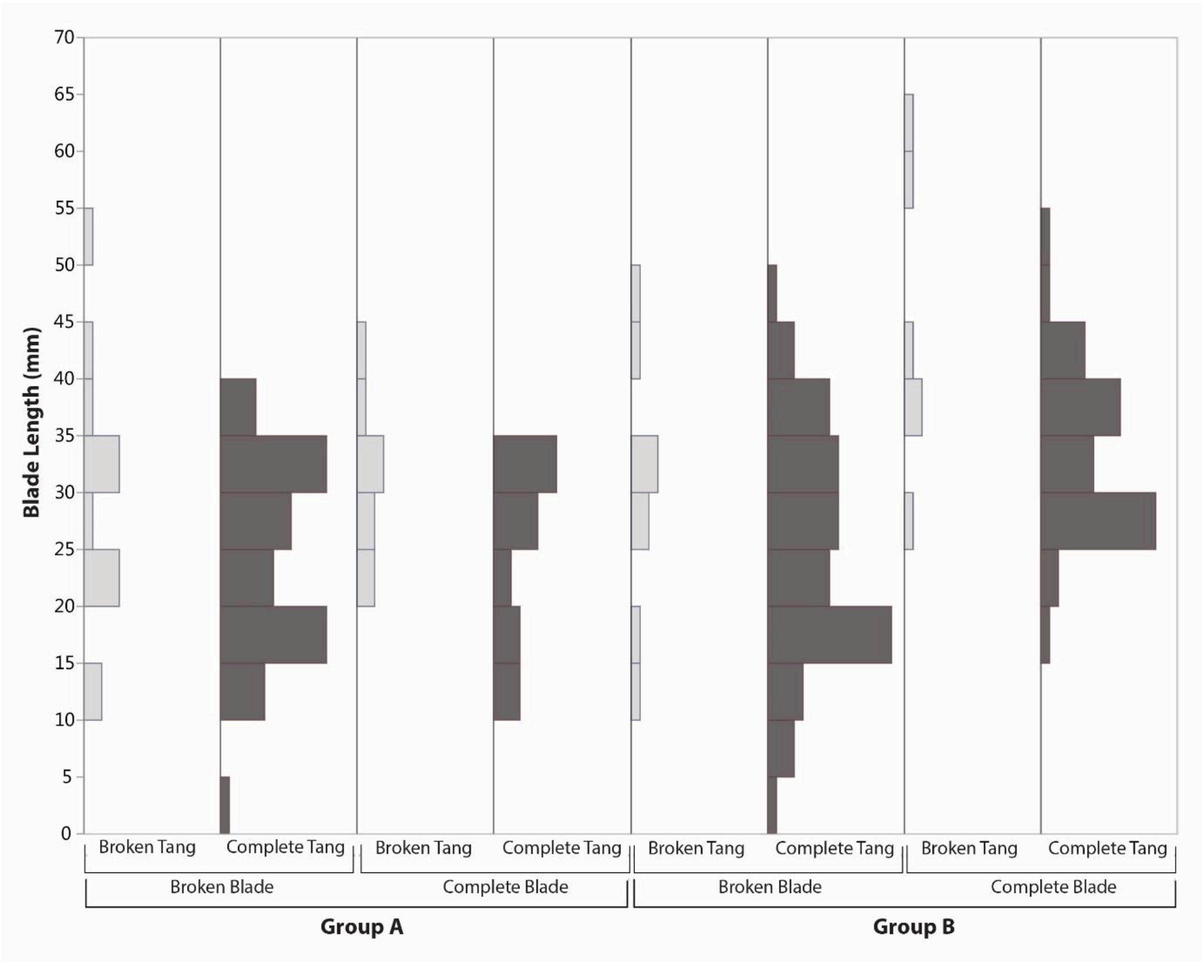


Figure 8: Distributions of blade length among points with broken blades and broken tangs, Group A and Group B.

are typologically Taylor) is more closely related to the use of these tools as knives or saws rather than their projectile function. It is plausible (though not demonstrable with the present data), however, that the thicker necks and narrower blades of the beveled Taylor points were more resistant to major fractures during impact than the wider blades of Kirk points. In other words while the form of Taylor points may have been strongly conditioned by use/rejuvenation unrelated to a projectile function, that form may have affected the breakage patterns caused by use as projectiles. Differences in blade serration, though not quite statistically significant, are also consistent with the idea that the emphasis on cutting/sawing functions was greater in the Group A assemblage than the Group B assemblage.

Taken together, these observations suggest that while points in the Group A and Group B assemblages were used as both projectile points and hand tools, points in Group A probably served as hand tools (specifically for cutting/sawing) with greater frequency. Use, rejuvenation, and discard of points in Group A was *more often* (not exclusively) contained within the "hand tool" portion of the flow chart in Figure 9, where the blades of points were used in non-impact contexts and then carefully resharpened to preserve as much of the remaining blade length as possible. A relative de-emphasis in "hand tool" tasks among the Group B points probably explains the lower incidence of bevel resharpening and blade serration and the apparently greater frequency of breaks in the proximal portion of the blades. Relative to Group B, more tools in Group A finished their lives as exhausted hand tools rather than as broken projectiles. Use-wear analysis could be employed in the future to evaluate this conclusion.

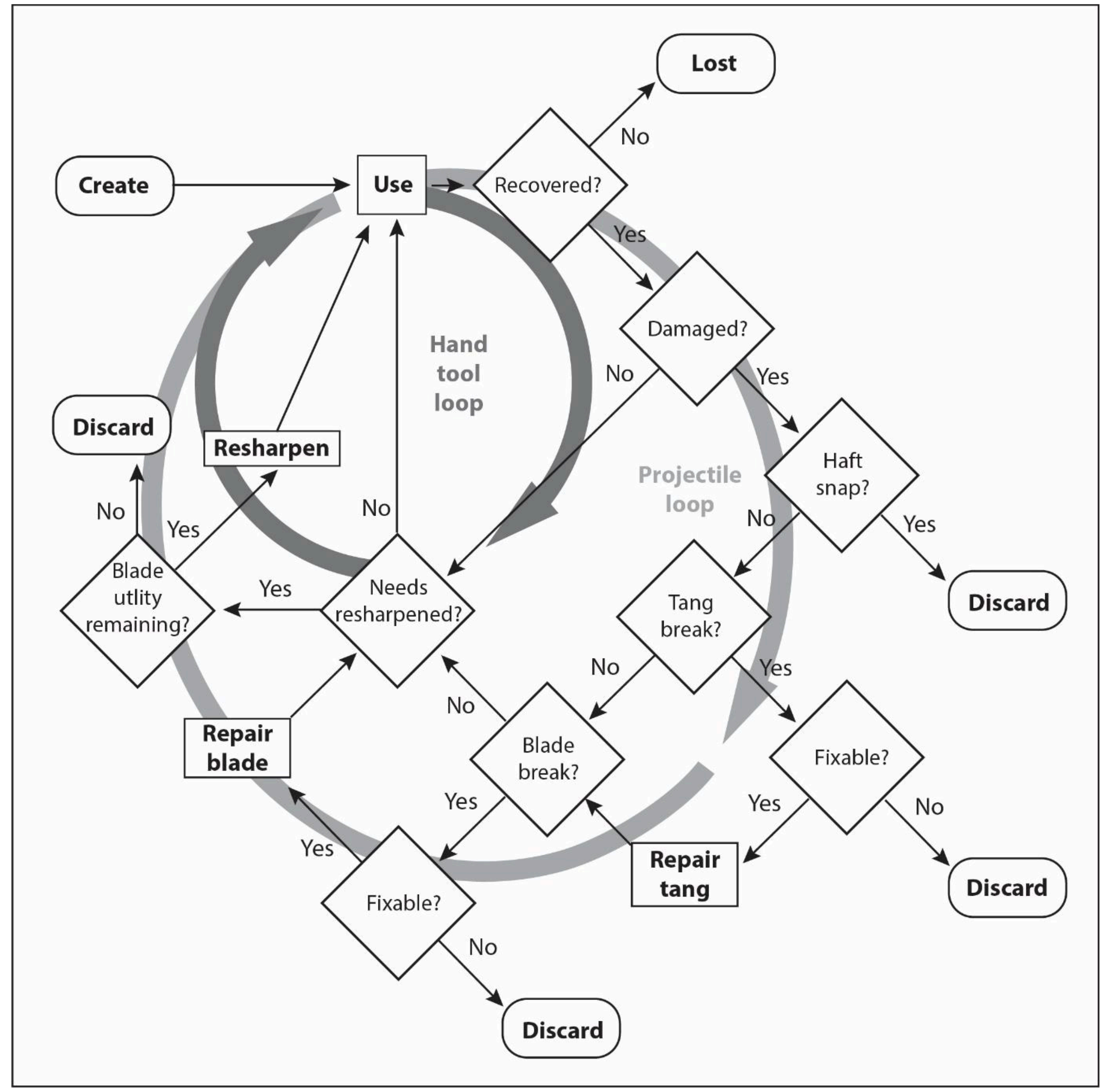


Figure 9: General model of processes of use, breakage, rejuvenation, and discard among Early Archaic hafted bifaces.

In terms of Bleed's (1986) terminology, the Early Archaic tool *systems* of which these points are one component appear to have been designed with an emphasis on maintainability. Maintainable systems have modular designs (with components that can be replaced when they fail), can be maintained by the users, and can be easily repaired at almost any time (Bleed 1986:739). Reliable systems, in contrast, feature over-designed, well-crafted components and redundant subsystems, and are often made and maintained by specialists at scheduled times (Bleed 1986:739). While the Early Archaic points themselves were typically of high craftsmanship (a hallmark of reliable systems) they were also components that were replaced and/or repaired with a high frequency. The low CV values seen in the dimensions of the neck are consistent with the points being components of a "maintainable" system with easily interchangeable parts (Bleed 1986). The flexibility of these Early Archaic tools – as evidenced by their use as both projectiles and hand tools – is also consistent with their role as components within a maintainable system.

If the interpretation of the differences between the Group A (side notched) and Group B (corner notched) assemblages is correct, the decreased emphasis over time on the use of points as hand tools may be linked to shifts in technological and/or settlement organization during the Early Archaic period. While specific links between these apparent differences in tool use/discard behaviors and broader aspects of social and technological organization are difficult to demonstrate at this time, several studies hint at patterned changes between the "Taylor" and "Kirk" portions of the Early Archaic period that are relevant to putting these observations about functional variability in context.

The densities and distributions of Taylor and Kirk points across the region appear to be dissimilar. In terms of raw numbers, Kirk Corner Notched and Palmer points outnumbered Taylor points about 6.5:1 in the state-wide South Carolina data described by Charles and Moore (2018). Some of the discrepancy in their total numbers can be attributed to the more localized distribution of Taylor points, which appears to be focused in the southern part of the state and is largely non-isomorphic with that of Hardaway Side Notched. Within the Larry Strong Collection itself (representing Allendale County, South Carolina), Kirk points outnumber Taylor points by a much lower ratio of about 1.4:1. Corner notched points outnumber side notched points about 1.15:1 in Wilkinson's sample (2017:Table 5.22). Given that the temporal range of Taylor is likely less than Kirk (about 500 and 700 calendar years, respectively), the point totals appear at least roughly comparable in areas of the state where both forms are common.

Most studies of Early Archaic mobility in the region have focused on the Kirk portion of the period. Based on analysis of both excavated and surface assemblages, Anderson and Schuldenrein (1983:201) concluded that Kirk societies were organized into residentially-mobile foraging groups with "a fair degree of group mobility." They noted that points made from Allendale (Coastal Plain) chert were transported up to 160 km from source areas. Daniel (1998:Figure 7.4) observed a similar scale of transport among Kirk points made from Uwharrie rhyolite (found in North Carolina), with a steep fall-off in the use of the material occurring between 150-200 km from the source. Wilkinson's (2017:Figure 5.7) data show a more gradual decrease-with-distance in the transport of Coastal Plain chert by Kirk groups, but are not inconsistent with the general idea that Kirk peoples were routinely transporting points made from some raw materials between 150-200 km from source areas. Based on a sample including both Kirk and Taylor points, Sassaman et al. (1988) argued for a total minimal range of Early Archaic bands on the order of 350 km.

Although the various models proposed to sketch the outlines of Early Archaic settlement in this region differ significantly (e.g., Anderson and Hanson 1988; Daniel 2001; Sassaman 1996), there seems no reason to doubt the basic premise that relatively high scales of residential mobility were a significant component of the strategies of Kirk (corner notched) groups. While somewhat less attention has been paid to the earlier Early Archaic use of the region, specifically by people using Taylor (side notched) points, available data suggest Taylor points may have been transported shorter distances from source areas on average than Kirk points (see Charles and Moore 2018; Wilkinson 2017:Figures 5.6 and 5.7). An overall lower degree of mobility among Taylor groups would be also be consistent with the greater use of local raw materials (e.g., quartz) in areas distant from source areas of Coastal Plain chert. Wilkinson (2018) and Goodyear (2014) both noted that Kirk points in the interior of the state were more likely than Taylor points to be made from the "exotic" raw materials like Coast Plain chert, reasoning that groups using Kirk points were likely staying in that region of the state for shorter periods of time than groups using Taylor points.

Slower travel across the landscape (related to making fewer and/or shorter residential moves) by Taylor-using peoples relative to Kirk-using peoples, as implied by the available raw material transport data, would be consistent with the conservative nature of Taylor use and rejuvenation strategies observed in the assemblage considered here. It is logical that more conservative strategies of tool curation/maintenance would have been employed when opportunities to replace cutting tools – where blade length was a key component of "utility" -- using a suitable raw material were fewer and farther between. Less frequent access to high quality raw materials like Coastal Plain chert would have encouraged two things: (1) the careful resharpening of points to prolong their use-lives; and (2) continued use of the tools closer to the point complete exhaustion. Points made from Coastal Plain chert (with their potentially long blades) might have been conserved as cutting tools while materials like quartz (plentiful but available in smaller packages) were used to make points to serve as easily-broken projectile tips. The emphasis on tool maintenance in the Group A (Taylor) assemblage is consistent with this scenario.

The appearance of "large" and "small" varieties of Kirk points (with no similar size modes apparent among Taylor points) could be connected to the emergence of greater specialization within the Early Archaic tool kit, perhaps linked to the increase in the scale/frequency of residential mobility suggested by the raw material transport data. It seems plausible that larger points were produced to function primarily as knives/saws while smaller points were crafted to serve primarily as the tips of projectile weapons. The larger starting size of these bigger (Kirk) points, coupled with more frequent opportunities to re-tool, could have reduced the need to employ alternate edge beveling to conserve blade length. It may have also been linked to a greater willingness to abandon rather than repair a broken point, accounting for the greater range of blade lengths in the Group B assemblage relative to Group A.

Differences in mobility between Taylor and Kirk groups were presumably related to patterned changes in the scales, frequencies, and structures of movements by small social groups (i.e., individuals, families, and foraging groups) during the course of the Early Archaic period. In other words, it is likely that increased mobility during Kirk times was also associated with some kind of structural change in how the landscape was used. Wilkinson's (2017) data suggest that there *were* significant differences in the ways that Taylor and Kirk peoples used, rejuvenated, and discarded points across the central portion of South Carolina. It is currently unclear, however, how those differences in archaeological assemblages are linked to specific differences in prehistoric behaviors.

Conclusion

The social and technological changes which unfolded across the Eastern Woodlands between about 10,000 and 8,800 RCYBP (10,800-9,600 cal YBP) remain largely unexplored and poorly understood. This study provides a small window into apparent functional shifts that occurred during this period. By utilizing a relatively large sample and holding raw material and geographic location constant, it is possible to compare and contrast patterns of design, use, rejuvenation, and discard between earlier (side notched) and later (corner notched) assemblages. Slight but statistically significant differences are apparent in patterns related to both (1) the tasks for which these tools were used (i.e., as hand tools and/or projectiles) and (2) decisions related to repair, rejuvenation, and discard.

The earlier assemblage (Group A) suggests that side notched points were more often used as hand tools relative to corner notched points (Group B), and were more carefully rejuvenated to conserve blade length (and possibly to conserve use-life in general). This contrast certainly relates in some way to strategic differences in how the groups represented by these assemblages moved across the landscapes of this portion of the Eastern Woodlands. Raw material transport data suggests that Kirk groups probably moved across the landscape more rapidly than Taylor groups. The de-emphasis on use of points as hand tools among Kirk groups (i.e., groups using corner notched points) may have been the result of both increased residential mobility and an overall reduction in the multi-functionality of chipped stone points that coincided with the emergence of technological systems incorporating a greater number of more specialized tools.

An analysis of both bifacial and non-bifacial tools from excavated assemblages would be required to more thoroughly examine changes within Early Archaic tool kits, and a large scale analysis of change in Early Archaic mobility patterns will be required to place these observations in context. For now, the idea that changes in patterns of design, use, and discard of hafted bifaces from side notched to corner notched times are related to an increase the scales and/or frequencies of residential mobility will remain a hypothesis.

This study provides a baseline to which other assemblages of Early Archaic projectile points can be compared. The metric and non-metric variables used are well-defined and observations made using those variables should exhibit a high degree of replicability. It is likely that the patterns seen in samples from areas located farther from good quality lithic raw materials and in different physiographic regions will differ from the results described here. It is those differences that will help us identify and describe variability on large scales and develop specific explanatory models to investigate the causes of changes seen during the Early Archaic period across the Eastern Woodlands.

Acknowledgments

This paper would not have been possible without the support of the Archaeological Research Trust, which funded the initial effort to inventory the Early Archaic materials from the Larry Strong collection. Dr. Larry Strong's contribution to our potential to learn about this time period in this region is significant. I have benefitted from conversations about these points with both Al Goodyear and Joe Wilkinson, who may or may not agree with my interpretations. This paper was also improved by the comments of several anonymous reviewers and Philip Carr. This paper represents another step in the transfer of my research agenda from the Midwest to the Southeast. While many of the corner notched points look the same in both regions, the side notched ones do not. Someday we'll have a good answer as to why that is. I take the blame for any errors, logical issues, and oversights. Thank you for reading my acknowledgements.

References Cited

Adovasio, J. M. and Kurt W. Carr
2009 Shades of Gray: The Paleoindian-Early Archaic "Transition" in the Northeast. In *Sourcebook of Paleolithic Transitions*, edited by Marta Camps and Parth Chauhan, pp. 503-525. Springer, New York.

Anderson, David G., and Joseph Schuldenrein
1983 Early Archaic Settlement on the Southeastern Atlantic Slope: A View from the Rucker's Bottom Site, Elbert County, Georgia. *North American Archaeologist* 4(3): 177-210.

Anderson, David G., and Glenn Hanson
1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Valley. *American Antiquity* 53(2): 18-32.

Bleed, Peter
1986 The Optimal Design of Hunting Weapons: Maintainability or Reliability. *American Antiquity* 41(4):737-747.

Bridgman Sweeney, Kara
2013 *A Complex Web of History and Artifact Types in the Early Archaic Southeast*. Unpublished Ph.D. Dissertation, University of Florida, Gainesville.

Brookes, Samuel O.
1985 The Kirk Point that Ate the Eastern United States. *Mississippi Archaeology* 20(2):24-31.

Bullen, Ripley P.
1975 A Guide to the Identification of Florida Projectile Points. Revised Edition. Kendall Books, Gainesville, Florida.

Cable, John S.
1996 Haw River Revisited: Implications for Modeling Terminal Late Glacial and Early Holocene Hunter-Gatherer Settlement Systems in the Southeast. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 107-148. The University of Alabama Press, Tuscaloosa and London.

Cantin, Mark
2000 Comparative Analysis of Thebes and Kirk Lithic Technology and Home Range Implications in Southwestern Indiana. Unpublished M.A. thesis, Indiana State University, Terre Haute, Indiana.

Chapman, Jefferson C.
1976 The Archaic Period in the Lower Little Tennessee River Valley: The Radiocarbon Dates. *Tennessee Anthropologist* I (1):1-12.

Charles, Tommy, and Christopher R. Moore
2018 *Prehistoric Chipped Stone Tools of South Carolina*. Piedmont Archaeological Studies Trust, Glendale, South Carolina.

Cheshier, Joseph, and Robert Kelly
2006 Projectile Point Shape and Durability: The Effect of Thickness:Length. *American Antiquity* 71(2):353-363.

Christenson, Andrew L.

1986 Projectile Point Size and Projectile Aerodynamics: An Exploratory Study. *Plains Anthropologist* 31:109-128.

Coe, Joffre L.
1964 The Formative Cultures of the Carolina Piedmont. *Transactions of the American Philosophical Society* 54(5). Philadelphia.

Daniel, I. Randolph, Jr.
1998 *Hardaway Revisited: Early Archaic Settlement in The Southeast*. Tuscaloosa; University of Alabama Press.
2001 Stone Raw Material Availability and Early Archaic Settlement in the Southeastern United States. *American Antiquity* 66(2): 237-265.

DeRegnaucourt, Tony
1992 *Field Guide to the Prehistoric Point Types of Indiana and Ohio*. Occasional Monographs of the Upper Miami Valley Archaeological Research Museum Number 1. Second printing (revised edition).

Dockall, John E.
1997 Wear Traces and Projectile Impact: A Review of the Experimental and Archaeological Evidence. *Journal of Field Archaeology* 24:321-331.

Driskell, Boyce N.
1996 Stratified Late Pleistocene and Early Holocene Deposits at Dust Cave, Northwestern Alabama. In *The Paleoindian and Early Archaic Southeast,* edited by David G. Anderson and Kenneth E. Sassaman, pp. 315-330. University of Alabama Press, Tuscaloosa.

Ellis, Christopher J., Albert C. Goodyear, Dan F. Morse, and Kenneth B. Tankersley
1998 Archaeology of the Pleistocene-Holocene Transition in Eastern North America. *Quaternary International* 49/50:151-166.

Faught, Michael K., Michael B. Hornum, R. Christopher Goodwin, Brinnen Carter, and S. David Webb
2003 Earliest-Holocene Tool Assemblages from Northern Florida with Stratigraphically Controlled Radiocarbon Estimates (Sites 8LE2105 and 8JE591). *Current Research in the Pleistocene* 20:16-18.

Fischer, A., P. V. Hansen, and P. Rasmussen.
1984 Macro and Micro Wear Patterns on Lithic Projectile Points. *Journal of Danish Archaeology* 3:19-46.

Frison, George C.
1974 Archaeology of the Casper Site. In *The Casper Site: A Hell Gap Bison Kill on the High Plains*, edited by George C. Frison, pp. 1-111. Academic Press, New York.

Goodyear
1974 The Brand Site: A Techno-Functional Study of a Dalton Site in Northeast Arkansas. *Arkansas Archaeological Survey Research Series* No. 7.
2014 Paleoindian in COWASEE: Time, Typology, and Raw Material Selection. *South Carolina Antiquities* 46:3-20.

Goodyear, Albert C., and Tommy Charles
1984 *A Survey of Chert Quarries in Western Allendale County, South Carolina*. Research Manuscript Series 195. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Guthrie, R. D.
1983 Osseous Projectile Points: Biological Considerations Affecting Raw Material Selection and Design among Paleolithic and Paleoindian Peoples. In *Animals and Archaeology 1: Hunters and Their Prey*, edited by J. Clutton-Brock and C. Grigson, pp. 273-294. BAR International Series 163, Oxford.

Iovita, Radu, Holger Schönekeß, Sabine Gaudzinski-Windeuser, and Frank Jäger
2012 Projectile Impact Fractures and Launching Mechanisms: Results of a Controlled Ballistic Experiment using Replica Levallois Points. *Journal of Archaeological Science* 48:73-83.

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Indiana University Press, Bloomington.

Kamminga, Johan
1982 *Over the Edge: Functional Analysis of Australian Stone Tools*. Occasional Papers in Anthropology, Anthropology Museum, University of Queensland, St. Lucia.

Keeley, Lawrence H.
1982 Hafting and Retooling: Effects on the Archaeological Record. *American Antiquity* 47(4):798-809.

Kimball, Larry R.
1996 Early Archaic Settlement and Technology: Lessons from Tellico. In *The Paleoindian and Early Archaic Southeast*, edited by David G.

Anderson and Kenneth E. Sassaman, pp. 149-186. University of Alabama Press, Tuscaloosa.

Kneberg, Madeline
1956 Some Important Projectile Point Types Found in the Tennessee Area. *Tennessee Archaeologist* 12(1):17-28.

Lipo, Carl P., Robert C. Dunnell, Michael J. O'Brien, Veronica Harper, and John Dudgeon
2012 Beveled Projectile Points and Ballistics Technology. *American Antiquity* 77(4):774-788.

Meltzer, David J.
1981 A Study of Style and Function in a Class of Tools. *Journal of Field Archaeology* 8:313-326.

Meredith, Steven M.
2011 "Multiple Geologic Sources of Tool Stone as Indicator of Geographic Range of Early Archaic Societies in the Gulf South." Paper presented at the Society for American Archaeology annual meeting, Sacramento, California.

Michie, James L.
1966 The Taylor Point. *The Chesopiean* 4(5-6): 123-124.

Morse, Dan F. (editor)
1997 *Sloan: A Paleoindian Dalton Cemetery in Arkansas*. Smithsonian Institution Press, Washington, D. C.

Munson, Patrick J.
1986 What Happened in the Archaic in the Midwestern United States? *Reviews in Anthropology* Fall 1986.

Nolan, David J., and Richard L. Fishel
2009 Archaic Cultural Variation and Lifeways in West-Central Illinois. In *Archaic Societies: Diversity and Complexity Across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 401490. State University of New York Press, Albany.

Pettigrew, Devin B., John C. Whittaker, Justin Garnett, and Patrick Hashman
2015 How Atlatl Darts Behave: Beveled Points and the Relevance of Controlled Experiments. *American Antiquity* 80(3):590-601.

Sackett, James R.
1982 Approaches to Style in Lithic Archaeology. *Journal of Anthropological Archaeology* 1:59-112.

Sassaman, Kenneth E.
1996 Early Archaic Settlement in the South Carolina Coastal Plain. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 58-83. University of Alabama Press, Tuscaloosa.

Sassaman, Kenneth E., and David G. Anderson
1990 Typology and Chronology. In *Native American Prehistory of the Middle Savannah River Valley: A Synthesis of Archaeological Investigations of the Savannah River Site, Aiken and Barnwell Counties, South Carolina*, by Kenneth E. Sassaman, Mark J. Brooks, Glen T. Hanson, and David G. Anderson, pp. 143-216. Savannah River Archaeological Research Papers 1. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Sassaman, Kenneth E., Glen T. Hanson, and Tommy Charles
1988 Raw Material Procurement and the Reduction of Hunter-Gatherer Range in the Savannah River Valley. *Southeastern Archaeology* 7(2):79-94.

Schiffer, M. B., and Skibo, J. M.
1987 Theory and Experiment in the Study of Technological Change. *Current Anthropology* 28(5): 595-622.
1997 The Explanation of Artifact Variability. *American Antiquity* 62(1):27-50.

Sherwood, Sarah C., Boyce N. Driskell, Asa R. Randall, and Scott C. Meeks
2004 Chronology and Stratigraphy at Dust Cave, Alabama. *American Antiquity* 69:533-554.

Shott, Michael J.
1990 Stone Tools and Economics: Great Lakes Paleoindian Examples. In *Early Paleoindian Economies of Eastern North America,* edited by K. B. Tankersley and B. L. Isaac, pp. 3-43. Research in Economic Anthropology, Supplement 5. JAI Press, Greenwich, Connecticut.
1996 Innovation and Selection in Prehistory: A Case Study from the American Bottom. In *Stone Tools: Theoretical Insights into Human Prehistory,* edited by George Odell, pp. 279-309. Plenum Press, New York.
1997 Stones and Shafts Redux: The Metric Discrimination of Chipped-Stone Dart and

Arrow Points. *American Antiquity* 62(1):86-101.

Simpson, George Gaylord, and Anne Roe
1939 *Quantitative Zoology*. McGraw Hill, New York.

Sollberger, John B.
1971 A Technological Study of Beveled Knives. *Plains Anthropologist* 15-16:209-218.

Stafford, C. Russell
1994 Structural Changes in Archaic Landscape Use in the Dissected Uplands of Southwestern Indiana. *American Antiquity* 59:219-237.

Stafford, C. Russell, and Mark Cantin
2009 Archaic Period Chronology in the Hill Country of Southern Indiana. In *Archaic Transitions in Ohio and Kentucky Prehistory*, edited by Olaf H. Prufer, Sara E. Pedde, and Richard S. Meindl, pp. 287-313. The Kent State University Press, Kent, Ohio.

Thomas, David H.
1978 Arrowheads and Atlatl Darts: How the Stones Got the Shaft. *American Antiquity* 43:461-472.
1986 *Refiguring Anthropology: First Principles of Probability and Statistics*. Waveland Press, Prospect Heights, Illinois.

Titmus, Gene L., and James C. Woods
1986 An Experimental Study of Projectile Point Fracture Patterns. *Journal of California and Great Basin Anthropology* 8(1):37-49.
1991 A Closer Look at Margin "Grinding" on Folsom and Clovis Points. *Journal of California and Great Basin Anthropology* 13(2):194-203.

Tuck, James A.
1974 Early Archaic Horizons in Eastern North America. *Archaeology of Eastern North America* 2(1):72-80.

Werner, Angelia No.
2017 *Experimental Assessment of Proximal-Lateral Edge Grinding on Haft Damage Using Replicated Clovis Points*. Unpublished M. A. Thesis, Kent State University.

White, Andrew A.
2008 A Developmental Perspective on Technological Change. *World Archaeology* 40(4):597-608.
2012 *The Social Networks of Early Hunter-Gatherers in Midcontinental North America*. Ph.D. Dissertation, Department of Anthropology, University of Michigan, Ann Arbor.
2014 Changing Scales of Lithic Raw Material Transport among Early Hunter-Gatherers in Midcontinental North America. *Archaeology of Eastern North America* 42:51-75.
2016a The Research Potential of Large Surface Collections: The Larry Strong Example. *Legacy* 20(2):14-15.
2016b A Preliminary Analysis of Haft Variability in South Carolina Kirk Points. *South Carolina Antiquities* 48:41-53.

Wilkinson, Joseph E.
2017 Modeling Early Archaic Mobility and Subsistence: Evaluating Resource Risk Across the South Carolina Landscape. Unpublished M.A. Thesis, University of South Carolina, Columbia.
2018 From the Savannah to the Santee River: Early Archaic Mobility and Raw Material Utilization in the Coastal Plain of South Carolina. In *Early Human Life on the Southeastern Coastal Plain*, edited by Albert C. Goodyear and Christopher R. Moore, pp. 274-298. University of Florida Press, Gainesville.

Artifacts and Accessibility: 3-D Technologies for Museum Exhibits

Carolyn Dillian and Katie Stringer Clary

The role of three-dimensional (3-D) scanning and 3-D printing in archaeology has grown exponentially over the past ten years. An informal survey yields evidence of this growth in the significant increase in the number of presentations at the Society for American Archaeology (SAA) annual meeting that focus on 3-D technologies. For example, in 2009, approximately ten papers discussed 3-D scanning, but by 2019, there were over 100 papers or posters highlighting the use of 3-D technologies for a wide range of archaeological applications (SAA meeting archives available at www.saa.org). From the ability to accurately measure and research digital artifact images, without the need to handle originals; to the sharing of data; to the 3-D printing and reconstruction of artifacts, fossils, sites, and architectural features (Balletti et al. 2017, Berger et al. 2015, Davis et al. 2017, Lewis 2019, Means 2015, Vranich 2018), this technology has created significant opportunities for archaeological scholarship and public engagement through increased access to sensitive and limited resources using cost-effective methods that provide accurate and precise models of archaeological resources (McCuistion 2013; Means 2015, 2017a, 2017b, 2017c; Means et al. 2013a).

Museums' use of 3-D scanning and printing is also increasing, as a means to document artifacts and specimens, as a method to create or restore accurate replicas for study or display, and as a way to make collections digitally available to anyone who wishes to access or print them. In an early example of a museum's use of this technology for the public, the American Museum of Natural History made 3-D scans available as part of an educational program that resulted in 3-D prints of fossils from several species of dinosaur (Horn 2013). However, the use of 3-D scanning and printing is not just a novelty for public outreach and education. It can benefit researchers all over the world by providing remote access to specimens that can be replicated simply, accurately, and inexpensively. This is a boon to researchers who are unable to afford travel to collections and to museums who wish to encourage research and engagement with their holdings but do not have the resources, staff, or facilities to enable access.

As a great example of this, the National Museums of Kenya (NMK) has recently completed an extensive scanning project of artifacts and fossils in their collections, resulting in a massive database of 3-D models with associated research data that can be accessed from anywhere in the world. The project was made possible through Amazon Web Services (AWS) and Intel, implemented through Digital Divide Data Kenya (DDD). When finally made available online, this will create a virtual museum experience for the public and create access to rare and delicate artifacts and fossils for researchers around the world (Digital Divide Data 2019 and https://www.museums.or.ke/virtual-museum/). NMK now has the ability to cost-effectively facilitate access to collections and encourage research on their vast holdings of archaeological, paleontological, geological, and cultural materials. Additionally, with permission, NMK is linking data and specimens in the form of published and unpublished research that assists scholars and avoids duplication of efforts.

As another example, 3-D scans of fossil hominins from Dinaledi Cave in South Africa were created and provided online to any researcher interested in accessing them. The original fossils are housed at the Evolutionary Studies Institute at the University of the Witwatersrand, but for scholars unable to travel to that repository, accurate 3-D scans can be studied and printed (Berger et al. 2015; scans available at: https://www.morphosource.org/Detail/ProjectDetail/Show/project_id/124). This is important for researchers, since the original fossils cannot be transported out of South Africa as per a 1998 resolution by the Permanent Council of the UNESCO-affiliated International Association for the Study of Human Paleontology (Nutt 2015). As a result, unless scholars can obtain permits and funding for travel to work with the original specimens housed at the University of the Witwatersrand in South Africa, they are very limited in their research opportunities with the *Homo naledi* specimens. Providing 3-D scans online increases access and scholarship. Furthermore, the use of these fossil replicas in classrooms and public programs, including by one of us (Dillian), has provided hands-on experiential learning opportunities in human evolution for larger audiences.

However, there's debate about whether 3-D scans of artifacts, fossils, or human remains should be made available to the public (Hassett 2018a, 2018b; Robbins Schug et al. n.d.). Some researchers may want or need to retain exclusive control over their data, in the form of artifacts, fossils, or specimens, collected as part of their projects while analysis is underway (although the SAA Principles of Archaeological Ethics state that "…a researcher may have primary access to original materials and documents for a limited and reasonable time, after which these materials and documents must be made available to others" https://www.saa.org/career-practice/ethics-in-professional-archaeology). In other instances, museums may support their employees through fees generated by charging for making casts of specimens or through the bench fees charged to researchers wishing to work in their collections, as is the case at NMK where many staff are supported by fees paid by visiting scholars (Lewis 2019). In another possible scenario, descendant communities may not want to permit digital images of their ancestors' belongings to be shared or potentially replicated. But, despite these objections, in some cases, granting agencies may require public dissemination of some or all data gathered as a result of their funding, and 3-D scans may be one option for complying with those requirements (Lewis 2019).

Scope and Purpose of this Project

A newly emerging value of 3-D scanning and 3-D printing is the potential for these technologies to create increased accessibility for museum audiences with visual or sensory differences (Means 2015). In this way, it can provide immense benefits to a demographic often excluded from museum programming. Here, we outline a 3-D scanning and printing project conducted in partnership with the Horry County Museum, in Conway, South Carolina. The project was designed to benefit museum-going audiences who may struggle to engage with artifacts housed in glass display cases and accompanied by traditional text, but ultimately benefits all audiences through principles of museum universal design. By scanning and then creating 3-D replicas of authentic museum artifacts that could be explored through touch, the project vastly expanded exhibit accessibility to this audience. As part of the process, input was solicited from stakeholder communities, including individuals with visual and sensory differences and organizations that serve these communities. As an additional educational advantage, the project provided valuable experiential learning opportunities for students in upper-level classes in anthropology and history at Coastal Carolina University.

The 3-D scanned and 3-D printed objects included a range of archaeological and historical artifacts from the collections in the Horry County Museum that broadly reflected the region's prehistory and history. These replicated materials were then assembled with accompanying interpretive text and audio to create a tactile, accessible exhibit. The exhibit design allowed museum audiences to touch the 3-D replicas and experience exhibit narration through braille and audio, as well as traditional text. The project followed practices of universal design, in which an inclusive exhibit was created that would benefit all audiences, not just those with visual or sensory differences. Furthermore, additional benefits extended to university students and the professional museum community. Coastal Carolina University students assisted with scanning, printing, and exhibit narration (text, audio, and braille), providing opportunities for them to learn about Horry County's history and prehistory, as well as learn about accessibility in museum design. Museum professionals gained knowledge about the technology and its application in accessibility for their visually/sensory-impaired audiences during demonstrations that coincided with Horry County Museum's hosting of the South Carolina Federation of Museums conference. At the conclusion of the project, the public and the target audience, in partnership with organizations that serve these communities (SOS Health Care [autism services], the South Carolina Commission for the Blind, and special education classes from Horry County Schools) were invited for a grand opening of the exhibit and asked for feedback about the effectiveness of the design, allowing for critical review of the project from those who know best about the target audience's needs.

Museum Accessibility for the Visually/Sensory Impaired

Statistics published by the Rehabilitation Research and Training Center on Disability Statistics and Demographics at the University of New Hampshire recently counted 40,678,654 people, or 12.7% of the total population, living with a disability of some type in the United States. Of those, 7,536,691 or approximately 18.5%, lived with a vision disability, and 15,378,144, or 37.8% with a cognitive disability (Rehabilitation Research and Training Center on Disability Statistics and Demographics 2019). This is a large potential audience missing out on the opportunity to learn about archaeology and history in a museum setting, and museum administrators, exhibit designers, and educators are unintentionally neglecting a significant demographic.

Though museums were required to become accessible as a result of the Americans with Disabilities Act (ADA), passed in 1990, given the fragile nature of original archaeological and historical artifacts, full accessibility for those with visual and sensory differences may not always be possible (Asakawa et al. 2018, Braden 2016, Majewski 1987, Sherman 2008). For individuals with these types of disabilities, traditional museum displays can be problematic (Stringer 2013). These audiences may not be able to engage thoroughly with exhibits presented behind glass cases or through written text, images, or signage. Instead, this museum-going audience, and in fact all audiences, may have a better museum experience through engagement with tangible objects that may be explored through touch, accompanied by interpretation that may include audio, large-print, alternate fonts, and/or braille.

It is important to note that hands-on exhibits can benefit everyone, not just individuals with visual or sensory differences. Most modern museum education initiatives prioritize hands-on, object-centered programming for the demonstrated benefits it provides in engaging and educating audiences of all ages and abilities. Today's museums are places of "exchange, encounter, and education" (Schwartz 2006: 2), rather than merely secure repositories for valuable, rare, or unusual objects. Furthermore, hands-on exhibits provide a more in-depth understanding of the past for audiences by "making a personal connection to history and creating meaning for themselves" (Grove 1999: 18). Tangible exhibits endeavor to create "direct access to reproductions of primary sources, focus on the stories of real people from history, and information presented in a variety of ways" (Grove 1999: 18). Yet despite the goals of both the ADA and museum educators, and an incorporation of hands-on activities into museum exhibits, there is a difficult balance in presenting the past to the public this way. Not all objects in a museum's collection should or could be included in a hands-on exhibit, creating challenges for curators and educators (Gavin 2011: 156). As often rare, sometimes delicate, and frequently irreplaceable objects, archaeological and historical artifacts and their displays remain problematic for hands-on efforts in museums, and many museums have neglected opportunities for creating hands-on exhibits in archaeology and history (Gavin 2011: 161). 3-D scanning and printing offers a solution that fits with educational and outreach goals, while still maintaining the secure integrity of fragile archaeological and historical artifacts (French 2017, Knochel et al. 2018).

Stakeholders and Partnerships

Because this project was designed to primarily benefit those in the community who experience visual or sensory differences, consultation with stakeholders within this demographic was an important part of the design and implementation of 3-D scanning and printing for exhibit construction and for the interpretation and presentation of text. A number of stakeholders were consulted during the creation of this exhibit, including SOS Healthcare of Myrtle Beach, South Carolina, which serves individuals with autism and their families; and the South Carolina Commission for the Blind. Both organizations provided feedback about what exhibit elements work well for their communities, and what do not. For example, SOS Healthcare alerted us that some of their clients with autism have difficulty extrapolating from object to abstract ideas. Specifically, they cautioned us that the skull of a beaver that was in the exhibit may not immediately translate to an understanding of an actual, living beaver for some individuals with these sensory and processing differences. Instead, they suggested that we supplement our 3-D printed object, interpretive text, and audio, with images of beavers in their natural environment in order to assist these individuals. This suggestion was implemented in the exhibit design, and provided a benefit to all who viewed the exhibit by placing artifacts in context or illustrating their use.

Because many of the objects in the exhibit represented belongings made by the ancestors of Native American people, we also received advice and guidance from Chief Harold Hatcher of the Waccamaw Indian People, Aynor, South Carolina, whose traditional lands include Horry County, South Carolina. Chief Hatcher spoke with students on the Waccamaw Indian People and their history in Horry County and answered students' questions about ways to respectfully present Native American material culture, which influenced the tone and content of the interpretive text.

Finally, in instances where objects for the exhibit had clear documentation of donation and history, students interviewed family members, where appropriate, of those who used or donated these objects. This provided a great personal connection for students working on the project, and also enabled interpretive panels to present the stories of those who directly used or owned the items on display.

The exhibit was created in partnership with the Horry County Museum, with collaboration between the Museum, the University, stakeholders, and the public, creating a partnership that provided benefits to students and the community. By working with engaged publics, the project provides an example of co-creation in public archaeology and museums, in which archaeology becomes a conversation with our many publics and stakeholders, rather than merely an exercise in education and presentation. Co-creation enables these publics to contribute to the control and power of archaeological research and how it is interpreted, displayed, and experienced (Bollwerk et al. 2015: 180, Connolly 2015: 189). In the museum field, the term "co-creation" has gained a foothold in the collaborative public approach to museum design and experience, in which varied publics and stakeholders contribute to the creation, presentation, and engagement with artifacts and exhibits (Connolly 2015). The resulting museum experience provides a more in-depth and nuanced interpretation than would have been possible through a top-down approach and addresses the expressed needs of the public (Bollwerk et al. 2015, Connolly 2015: 189).

The mission of the Horry County Museum is "to collect and preserve material related to the prehistory, natural history, history and culture of Horry County; to interpret and to create exhibits of such materials and to prepare educational programs related to them for presentation to the public." The Horry County Museum typically gets approximately 25,000 visitors each year, mostly drawn from the local community, school groups, and organized tours, and most of whom will now have the opportunity to learn through an accessible exhibit, about Horry County's past.

The artifacts from the Horry County Museum's collection were selected for 3-D scanning and printing with a goal of providing a diverse subset of the collections. The artifacts included Native American artifacts spanning Paleoindian through to modern-day Native American culture and people, such as an assortment of prehistoric pottery (with varying surface treatments that may be of tactile interest), projectile points, a decorated pipe, and groundstone. The historic period in Horry County includes its military history because the former Myrtle Beach Air Force Base played a major role in the growth of the region, and this was represented in the 3-D exhibit by aviator goggles, buttons, and military medals/medallions. Other historic artifacts included children's toys and personal items, including an ear trumpet, used by individuals who were hard of hearing, which opens conversations about how people in the past may have overcome sensory differences of their own. At the request of the Museum's Director, the exhibit also contains three Pleistocene fossils. Collections related to the natural history of Horry County were included as 3-D replicas as well, such as an anole and a rhinoceros beetle, which provided an interesting tactile exploration for our target audience.

Methods

Archaeologists have quickly recognized the advantages of 3-D scanning and 3-D printing in site

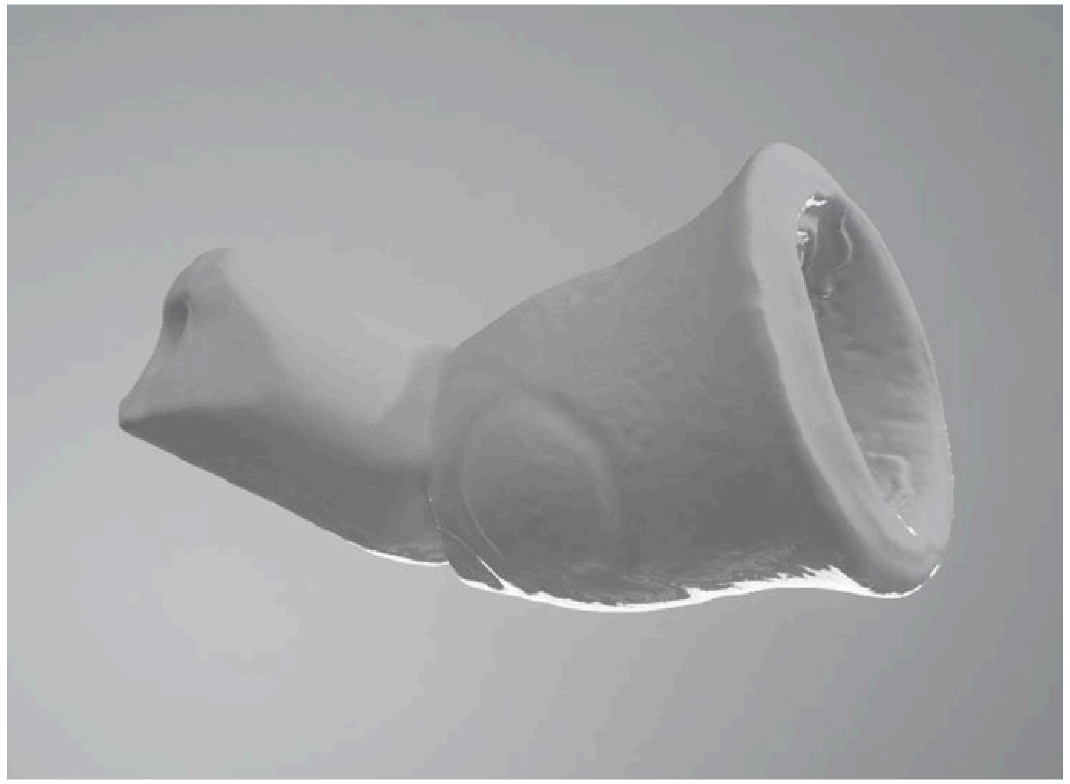


Figure 1: Completed 3-D scan of a steatite pipe fragment from Horry County, South Carolina.

and artifact documentation, dissemination of results, and replication of fragile artifacts and features (Balletti et al. 2017; Berger et al. 2015; Davis et al. 2017; Forte 2014; Forte et al. 2012; McCuistion 2013; Means 2015, 2017a, 2017b, 2017c; Means et al. 2013a, 2013b; Vranich 2018). Methods of 3-D data acquisition most commonly include laser scanning and photogrammetry, and there are a number of software applications that make processing data into 3-D models simple and easy (Davis et al. 2017). Methods of 3-D printing can include additive or subtractive technologies, such as inexpensive filament-based or resin-based 3-D printers that build a model using layers of material or more costly milling machines (Balletti et al. 2017).

For this project, artifacts were scanned using a NextEngine 3-D scanner (Figure 1) and edited using Scanstudio software in order to create accurate digital 3-D images of each object (for a more detailed discussion of the NextEngine scanner and its capabilities, see Means et al 2013a, 2013b). The scanner uses laser triangulation to scan the surface of the object, and also takes a photograph as the object rotates on a stage for a 360-degree scan, automatically compiling up to sixteen images to achieve up to 0.1mm resolution scans with full color. Users also can take additional bracketed or single scans (typically of the base and/or top of the object) and stitch them together in order to achieve a true 360-degree image. The large digital model file can be exported into a variety of file types for printing, study, or manipulation.

The 3-D scans were exported in this project as stereolithographic (STL) files and then 3-D printed using a Creality10s 3-D printer with Cura software for manipulation of 3-D files. Printing was done using 1.75mm 3-D printer filament in a variety of colors, capable of achieving +/- 0.03mm accuracy. Filament colors were selected to closely match individual artifacts, including metallic copper, brass, and silver. Multicolored artifacts were painted with acrylic paints to most closely mimic original colors. Students participated in the printing, processing, and painting of 3-D printed replicas for the exhibit.

Text was also designed for maximum accessibility for a wide range of audience needs. For example, panels were printed on foamboard using "dyslexie" font, designed to be easily read by individuals with dyslexia, and large-print booklets were also available for a low-vision audience's use.

Figure 2: Display panel from Printing the Past: SC in 3D exhibit showing the 3-D printed replica (upper left), a photograph of the original artifact (lower right), interpretive text in dyslexie font, QR code, and audio box. The text is replicated in braille printed on a transparent film affixed over the panel (slightly visible over the photograph in the lower right).

All text was also printed as transparent braille panels that were affixed over the exhibit text for braille readers, and audio buttons using EZSoundbox 200-second audio players provided audio for non-readers. All text and images could also be accessed using the QR codes printed on the exhibit panels that were linked to soundcloud files and the exhibit website. For individuals who required an environment with less noise and distraction, or who may need a louder volume, noise canceling headphones were available that could be plugged in to personal cell phones to access sound files via the QR codes on the exhibit panels.

The 3-D printed artifacts were mounted on individual stands, at 36 inches above the floor, which is the recommended height for items mounted flat on a pedestal or deck, according to the Smithsonian Guidelines for Accessible Exhibition Design (Smithsonian Institution). These stands contained the interpretive text, the audio box, the QR code link to audio files, and a photograph of the original artifact (Figure 2). In the center of the exhibit space, the original artifacts were also displayed in a traditional display case, but viewers were directed to the printed replicas on the exhibit stands for additional information.

Evaluation and Results

The objective of Printing the Past: SC in 3D was to remove barriers to access for those with disabilities by bringing a hands-on museum experience to a population that is unable to benefit from traditional museum exhibit design. However, benefits were not limited to the target audience of those with visual/sensory differences. We also sought to educate Coastal Carolina University students in 3-D scanning/printing and museum design and to educate museum professionals about the technology and ways it can be used to make museum exhibits more accessible. As a result, evaluation of the project design addressed its benefits to multiple audiences.

Evaluation of the effectiveness of the exhibit for the target audience was done through the use of an evaluation questionnaire (IRB 2019.217) administered on the opening day of the exhibit. A total of 171 people visited the exhibit on its opening day, and 95 people also attended an opening reception. A total of 51 people completed a survey upon exiting the exhibit, of which 39 (41%) completed the optional demographic portion and of those, 13 (33%) self-identified as having a disability or accessibility challenges. Respondents with disability and accessibility challenges offered suggestions in their evaluations to include bigger pictures and artifacts, and several requested headphones for the audio (which were provided, but only two pairs were available, and that was not enough for the opening day crowd). All of the respondents to the survey – including those who self-identified as not having a disability or accessibility challenges - stated that the ability to touch the 3-D printed artifacts greatly improved their museum experience.

Evaluation of the effectiveness of the exhibit on CCU students who participated in the design was conducted through online course evaluations that assessed experiential learning objectives. A total of 14 students completed online evaluations. Students stated that they enjoyed the project and learning the 3-D scanning/printing technology. The ability to see the project to completion and interact with its target audience was one of the biggest benefits. One student commented "The museum project for this course has by far been the best class project that I've done. Not only was it enjoyable in the sense that we had a lot of freedom in what we were doing, but the fact that it was applicable to a larger audience made the project that much more worthwhile. While projects that I've done in the past certainly helped me learn, this project went beyond that and really allowed students to create a project that we could be proud of and that will serve a larger audience in the long run."

However, perhaps the farthest-reaching impact is that this project serves as a model for other museums. The partnership between multiple University departments and the Museum allowed the use of sophisticated technology, which distributed costs that might otherwise have been prohibitive. The transparency in the development of this project, and the exhibition of our process within the exhibit and online, should serve to inspire other museums to create similar exhibits and partnerships.

Conclusion

The 3-D scanning and 3-D printing project that culminated in the exhibit Printing the Past: SC in 3D at the Horry County Museum in Conway, South Carolina, was a big success for students, faculty, the local community, and the target audience. The exhibit will remain on display at the Horry County Museum for one year, at which point, exhibit stands will be moved and placed throughout the Museum's hallways for visitors to explore while walking between other exhibits. Additional 3-D printed copies of artifacts and the accompanying text will be placed into education kits that are used in school outreach programs and teaching materials. The website for the exhibit will remain online with photographs, text, and audio links. Because all of the 3-D files have been digitally archived, additional artifacts can be printed at any time and re-installed or given to other museums and educational programs. This project demonstrates the far-reaching impact of 3-D scanning and printing for archaeology and history museums for accessibility and education, with cost-effective and measurable outcomes for all audiences.

Links to Additional Resources

Exhibit Website:
http://www.printingthepastscin3d.com

For people who are unable to visit the exhibit in person, students created a website that incorporates the audio and interpretation of the artifacts, as well as a layout of the floor plan, and information about the technology used to build this exhibit. Student perspectives on using the technology and creating the exhibit are also included.

SoundCloud:
https://soundcloud.com/user-475547154/printing-the-past-sc-in-3d

We used SoundCloud to host the audio for the exhibit. QR codes on each exhibit label lead to the SoundCloud audio for people to use on smartphones or from home. The audio is also incorporated on each artifact kiosk for people to use in the exhibit.

Exhibit Video:
https://www.youtube.com/watch?v=QoFlfWa09U8

This video is on display in the exhibit, as well as available in the online exhibit. The video, produced by Coastal Carolina University, Edwards College media services, shows the process of selecting artifacts, 3-D scanning, 3-D printing, and building the exhibit using new technologies.

Interactive Map:
https://www.arcgis.com/apps/webappviewer/index.html?id=0278e06efd4d4207857b6c355a06d8be

ANTH432 student Sydney James used GIS mapping technologies to create an interactive map of the artifacts and their original locations. Here, visitors can use the web map to identify where different artifacts on display in the Printing the Past: SC in 3D exhibit were found. Clicking on different locations, which are color-coded by the types of artifacts found there, provides the visitor with general information about some of the objects on display.

Acknowledgements

The exhibit, Printing the Past: SC in 3D was produced by Coastal Carolina University students in History 392: Museums and Communities and Anthropology 432: Cultural Resource Management, under the direction of Assistant Professor Katie Stringer Clary and Professor Carolyn Dillian. Our project greatly benefitted through conversations with a variety of stakeholders including SOS Healthcare, Myrtle Beach, SC, which serves individuals with autism and their families, and the South Carolina Commission for the Blind. We also appreciated conversations with the Interim CEO of the Pennsylvania Association for the Blind, John McInerney, who has provided consulting assistance to museums on accessibility for visually impaired audiences. And, we received advice and guidance from Chief Harold "Buster" Hatcher of the Waccamaw Indian People, Aynor, South Carolina, whose ancestors made the Native American belongings within the collections. Chief Hatcher spoke with students on the Waccamaw Indian People and their history in Horry County and answered students' questions about ways to respectfully present Native American material culture. Finally, we would like to thank the family members of those who used or donated historic artifacts that became part of the exhibit who kindly spoke to our students about the objects' histories. Funding for this project was provided by South Carolina Humanities, a not-for-profit organization; inspiring, engaging, and enriching South Carolinians with programs on literature, history, culture, and heritage; and by a Public Outreach grant from the Southeastern Archaeological Conference. Bernard Means provided helpful peer-review of this article, and we thank him for his time and contributions. Thank you to Coastal Carolina University, the Horry County Museum, and members of the campus and community for their assistance and support for this project.

References Cited

Asakawa, Saki, João Guerreiro, Dragan Ahmetovic, Kris M. Kitani, and Chieko Asakawa
2018 "The Present and Future of Museum Accessibility for People with Visual Impairments." In *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility - ASSETS '18*, pp. 382–384. ACM Press, Galway, Ireland.

Balletti, Caterina, Martina Ballarin, and Francesco Guerra
2017 3D Printing: State of the Art and Future Perspectives. *Journal of Cultural Heritage* 26:172-182.

Berger, Lee R., John Hawks, Darryl J. de Ruiter, Steven E. Churchill, Peter Schmid, Lucas K. Delezene, Tracy L. Kivell, Heather M. Garvin, Scott A. Williams, Jeremy M. DeSilva, Matthew M. Skinner, Charles M. Musiba, Noel Cameron, Trenton W. Holliday, William Harcourt-Smith, Rebecca R. Ackermann, Markus Bastir, Barry Bogin, Debra Bolter, Juliet Brophy, Zachary D. Cofran, Kimberly A. Congdon, Andrew S. Deane, Mana Dembo, Michelle Drapeau, Marina C. Elliott, Elen M. Feuerriegel, Daniel Garcia-Martinez, David J. Green, Alia Gurtov, Joel D. Irish, Ashley Kruger, Myra F. Laird, Damiano Marchi, Marc R. Meyer, Shahed Nalla, Enquye W. Negash, Caley M. Orr, Davorka Radovcic, Lauren Schroeder, Jill E. Scott, Zachary Throckmorton, Matthew W. Tocheri, Caroline VanSickle, Christopher S. Walker, Pianpian Wei, Bernhard Zipfel
2015 Homo naledi, a New Species of the Genus Homo from the Dinaledi Chamber, South Africa. eLife 4: e09560. https://doi.org/10.7554/eLife.09560.001

Bollwerk, Elizabeth, Robert Connolly, and Carol McDavid
2015 Co-Creation and Public Archaeology. *Advances in Archaeological Practice* 3(3):178-187.

Braden, Caroline
2016 Welcoming All Visitors: Museums, Accessibility, and Visitors with Disabilities. University of Michigan *Working Papers in Museum Studies* 12:1-15.

Connolly, Robert
2015 Co-Creation as a Twenty-First Century Archaeology Museum Practice. *Advances in Archaeological Practice* 3(3):188-197.

Davis, Annabelle, David Belton, Petra Helmholz, Paul Bourke, and Jo McDonald
2017 Pilbara Rock Art: Laser Scanning, Photogrammetry and 3D Photographic Reconstruction as Heritage Management Tools. *Heritage Science* 5(25):1-16.

Digital Divide Data
2019 Case Study: National Museums of Kenya. Electronic resource https://www.digitaldividedata.com/clients/case-studies/national-museums-of-kenya. Accessed October 9, 2019.

Forte, Maurizio
2014 3D Archaeology: New Perspectives and Challenges – the Example of Çatalhöyük. *Journal of Eastern Mediterranean Archaeology and Heritage Studies* 2(1):1-29.

Forte, Maurizio, Nicolo Dell'Unto, Justine Issavi, Lionel Onsurez, and Nicola Lercari
2012 3D Archaeology at Çatalhöyük. *International Journal of Heritage in the Digital Era* 1:351-378.

French, Yvonne
2017 3D Replicas Create Museums Where Touching is Encouraged. The National Library Service for the Blind and Physically Handicapped Quarterly Newsletter, April to June. Electronic resource https://www.loc.gov/nls/about/news/quarterly-newsletter-news/april-june-2017-newsletter/#_3d. Accessed November 6, 2019.

Gavin, Rebecca
2011 A Study of Interactives in Virginia Museums. *The Journal of Museum Education* 36(2):155-164.

Grove, Tim
1999 I Never Knew History Could Be So Fun! Visitor Experiences in the Hands-on-History Room. *History News* 54(4):18-20.

Hassett, Brenna R.
2018a The Ethical Challenge of Digital Bioarchaeological Data. *Archaeologies* 14(2):185-188.
2018b Which Bone to Pick: Creation, Curation, and Dissemination of Online 3-D Digital Bioarchaeological Data. *Archaeologies* 14(2):231-249.

Horn, Leslie
2013 How the AMNH is Using 3-D Printing to Copy Dinosaur Bones. Gizmodo. Electronic resource https://gizmodo.com/how-the-amnh-is-using-3d-printing-to-copy-dinosaur-bone-1477484404 Accessed August 1, 2019.

Knochel, Aaron D. Wen-Hsia Hsiao, and Alyssa Pittenger
2018 Touching to See: Tactile Learning, Assistive Technologies, and 3-D Printing. *Art Education* 71(3):7–13.

Lewis, Dyani
2019 The Fight for Control Over Virtual Fossils. *Nature* 567:20-23.

Majewski, Janice
1987 *Part of Your General Public Is Disabled: A Handbook for Guides in Museums, Zoos, and Historic Houses*. Smithsonian Institution Press, Washington, D.C.

McCuistion, Ashley
2013 Promoting the Past: The Educational Applications of 3D Scanning Technology in Archaeology. *Journal of Middle Atlantic Archaeology* 29:35-42.

Means, Bernard K.
2015 Promoting a More Interactive Public Archaeology: Archaeological Visualization and Reflexivity through Virtual Artifact Curation. *Advances in Archaeological Practice* 3(3):235-248.
2017a Seek Out a Diverse Range of Experiences. *The SAA Archaeological Record* 17 (3):33-35.
2017b A Digital Passport to the Past: The 'Accidental' Public Archaeology of the Virtual Curation Laboratory. *Public Archaeology* 15:1-9.

2017c Printing the Past: 3D Printed Artifact Replicas Aid in Research, *Education. Research & Development Magazine* 59(3):20-23.

Means, Bernard K., Ashley McCuistion, and Courtney Bowles

2013a Virtual Artifact Curation of the Historic Past and the NextEngine Desktop 3-D Scanner. *Technical Briefs in Historical Archaeology* 7:1-12. Electronic resource http://www.sha.org/documents/VirtualArtifacts.pdf. Accessed December 4, 2019.

Means, Bernard K., Courtney Bowles, Ashley McCuistion, and Clinton King

2013b *Virtual Artifact Curation: Three-Dimensional Digital Data Collection for Artifact Analysis and Interpretation*. Prepared for the Department of Defense Legacy Resource Management Program, Legacy Project #11-334, by the Virtual Curation Laboratory, Virginia Commonwealth University, Richmond.

Nutt, Amy Ellis

2015 Scientists Shocked the World with a Brand New Species of Man – But Who Owns the Bones? The Washington Post, 10 September 2015. Electronic resource https://www.washingtonpost.com/news/speaking-of-science/wp/2015/09/10/who-owns-those-bones/. Accessed November 6, 2019.

Rehabilitation Research and Training Center on Disability Statistics and Demographics

2019 2018 Annual Disability Statistics Compendium. Institute on Disability, University of New Hampshire. Electronic resource https://disabilitycompendium.org/. Accessed November 6, 2019.

Robbins Schug, Gwen, Kristina Killgrove, Alison Atkin, and Krista Baron

n.d. 3D Dead: Meaning, Agency, and Ethical Considerations in Digital Osteology. In J. J. Wells (Ed.) *Archaeological Informatics: Ethics in Practice*, Springer, New York.

Schwartz, Marjorie

2006 *Riches, Rivals, and Radicals: 100 Years of Museums*. American Association of Museums, Washington D. C.

Sherman, Daniel J.

2008 Museums and Difference. Indiana University Press, Indianapolis.

Smithsonian Institution

n.d. Smithsonian Guidelines for Accessible Exhibition Design. Electronic Resource https://www.sifacilities.si.edu/ae_center/pdf/Accessible-Exhibition-Design.pdf. Accessed December 3, 2019.

Stringer, Katie

2013 *Programming for People with Special Needs: A Guide for Museums and Historic Sites*. Rowman and Littlefield, Lanham, Maryland.

Vranich, Alexei

2018 Reconstructing Ancient Architecture at Tiwanaku, Bolivia: The Potential and Promise of 3D Printing. *Heritage Science* 6(65): 1-20.

A Chemical Method of Stain Removal Applied to Lithic Artifacts from Rivers in South Carolina and Florida: Cooper River (SC 583) and Suwannee River (FL 409)

Robert C. Costello and Albert C. Goodyear

The Coastal Plain of the Southeastern United States is characterized by what are called blackwater rivers and creeks and are present continuously from Virginia down through Florida (Wharton et al. 1982:Figure 1). Blackwater streams typically arise on the upper Coastal Plain and are fed by precipitation in contrast to rivers that originate in the mountains and Piedmont. Blackwater refers to the dark water column colored by tannins and other organics contributed by the water-tolerant bottomland vegetation such as cypress and tupelo. “Blackwater rivers (are) more acidic (lower pH) and are characterized by high concentrations of total organic carbon and low concentrations of dissolved inorganics.” (Wharton et al. 1982:21). The result of this type of aquatic environment is the coating of artifacts with a stain also called river varnish. This organic coating can often obscure the surface of lithic artifacts preventing observation of fossils native to certain cherts as well as seeing the flake scars in detail. The method described here was previously published by Costello (2017) in his effort to remove dark stains from a lithic artifact from Lake Marion South Carolina. This article reports on the results of applying the method to two lithic artifacts, one from the Cooper River in South Carolina and the other from the Suwannee River in Florida. We were interested in testing the general applicability of the method in blackwater streams as a means of enhancing artifact analysis.

SC 583 is the proximal portion of an unfluted lanceolate point recovered from the Cooper River by Doug Boehm and donated to SCIAA for study. It merited special attention as possibly being an important representative of the relatively small group of non-fluted Paleoindian points in South Carolina that currently are categorized as post-Clovis and post-Redstone but pre-Dalton in age. This era in South Carolina currently is under intensive study (Smallwood et al. 2018). SC 583 also is of special interest in that its basal structure resembles variants of the Suwannee and perhaps also Simpson projectile point types found in Florida (Dunbar, 2016). However, its basal structure could best be described as contracted and is considerably less markedly waisted than either the large majority of Suwannee and Simpson points or their postulated post-Clovis unfluted South Carolina relatives (Charles and Moore 2018). Upon completion of its documentation, SC 583 data will be recorded in the Paleoindian Database of the Americas. Current South Carolina entries, accessible at http://pidba.org/scimages.htm, were updated through SC 579 at the time of this writing.

Due to its river provenience, SC 583 was coated with a dark stain which completely obscured the visible features of the lithic material in all areas as well as its flaking pattern in some localized areas, Figure 1. Visual observation of chert features is a key step in ascertaining chert sources (Luedtke 1992). It was noted by Kenn Steffy that visibility of the flaking pattern was improved when this photo was edited into black and white mode using a blue filter and subjected to detail enhancement; however, the original version was selected for use herein in order to illustrate the color of the surface staining prior to cleaning.

Metric data for SC 583 are provided in Table 1. As noted below, the mass as measured with centigram precision was unaffected by our treatment. Length was measured as the maximum extension of the point along a line perpendicular

Figure 1: SC 583 prior to cleaning with 6M HCl.

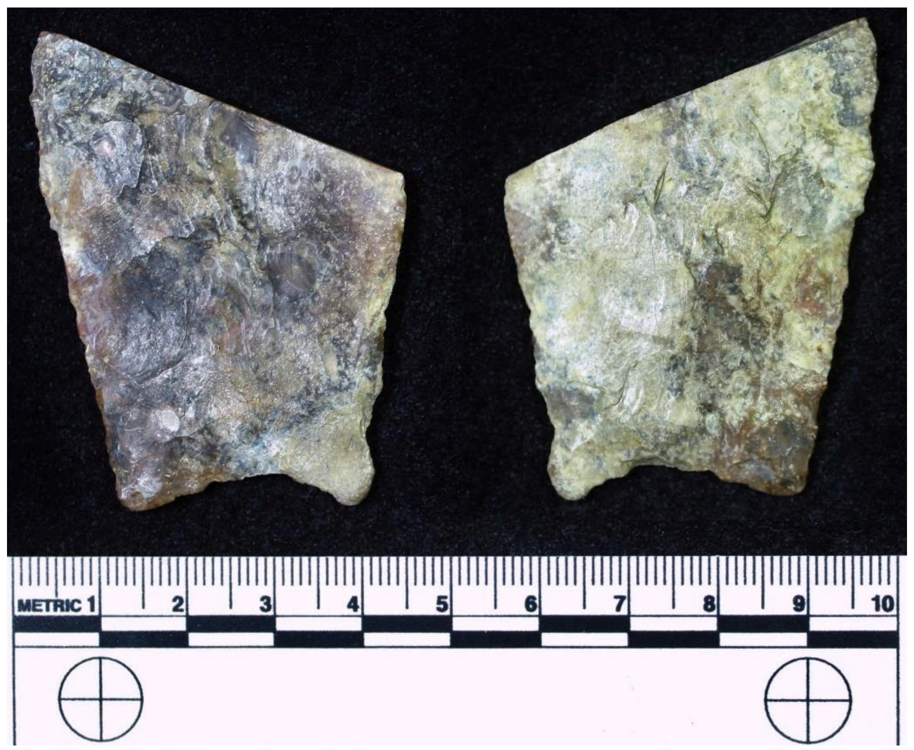


Figure 2: SC 583 subsequent to treatment with 6M HCl.

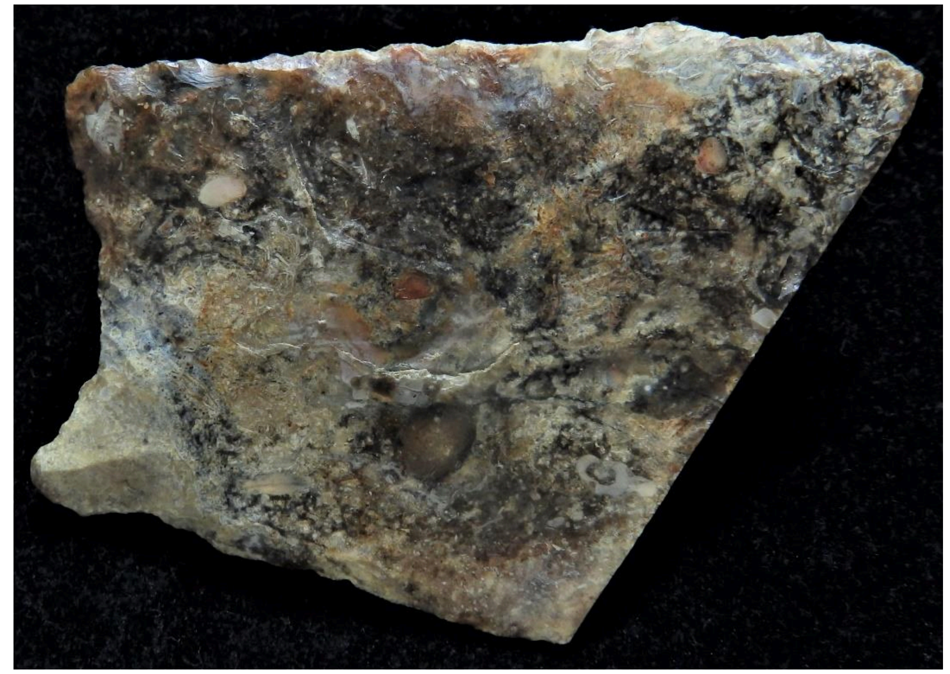


Figure 3: Lithic material detail on obverse side of SC 583 following cleaning.

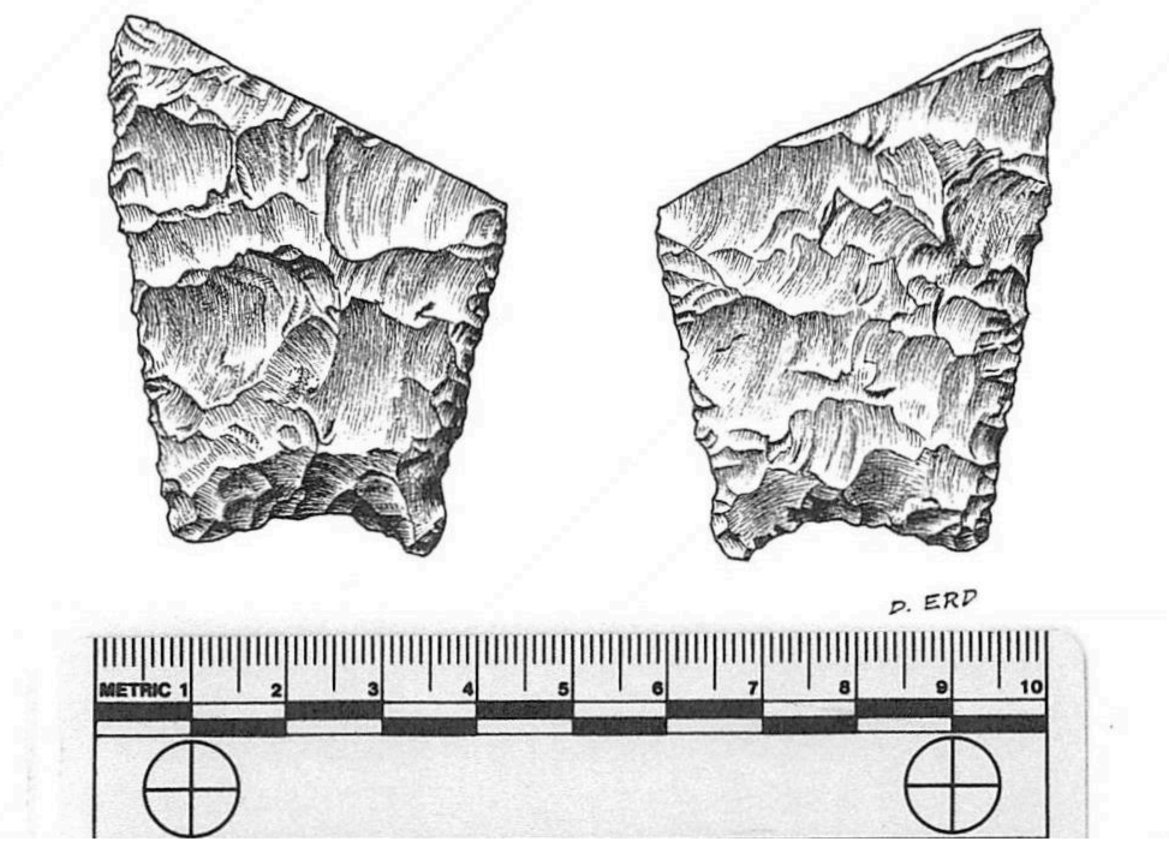


Figure 4: Line Drawing of SC 583.

Table 1: SC 583 Metric data.

attribute	mass (g)	length (mm)	width (mm)	thickness (mm)
value	14.65	54.25	42.01	6.90

to the plane of the base. The width was measured as the maximum extension of the point along a line parallel to the plane of the base. Since the distal portion is missing, the length measurement is attenuated from that of the original point; likewise, but to a much lesser extent, is the width measurement. The recorded thickness is the maximum thickness of the point. We note that the width of SC 583 falls beyond the range of widths listed and/or illustrated for South Carolina Paleo-Indian points (Charles and Moore 2018), but most closely approximates that of a Simpson analog, Figure 2.4 C, which it also resembles in shape with the exception of degree of waisting.

The authors undertook cleaning of this artifact using techniques applied previously to a stained flake tool recovered from Lake Marion (Costello 2017). Our expectation was that in addition to revealing the lithic material, surface cleaning might also enhance the visibility of flaking patterns. The latter could be useful in exploring possible associations with specific lithic technologies and cultures as well as facilitating creation of line drawings which comprise an important part of the archaeological record. Were the visual features of the lithic material of SC 583 most consistent with a type indigenous to Florida, the possibility of its transportation from that region would merit further consideration. Were the visual features of the lithic material identifiable as Allendale-Brier Creek chert or another recognizable South Carolina type such as Black Mingo chert or Wyboo chert (Costello and Steffy 2012), the implied cultural affiliation would focus on South Carolina and possibly adjacent areas of Georgia. The subject was treated for 30 minutes with 75 mL of 6M HCl (hydrochloric acid). This treatment time was intentionally shorter than the three hour treatment applied to the more expendable flake tool described previously (Costello 2017), as it was important to minimize risk of damage to this important and rare artifact. Yellowing of the acid wash solution was observed immediately after its addition. At the end of the treatment 5 mL of 0.20 M KSCN (potassium thiocyanate) test reagent was added. This resulted in the appearance of an orange color attributable to the formation of $FeSCN^{2+}$ (thiocyantoiron(III)) complex ions in a chemical reaction in solution between Fe^{3+} (iron(III) or ferric) ions eluted from the surface stain and SCN^{-} (thiocyanate) ions contributed by the test reagent. Following HCl treatment the acidic solution was decanted and the artifact washed with several changes of deionized water. It then was soaked in several changes of deionized water to remove all traces of HCl. After several days of drying, the mass of SC 583 had returned to the value of 14.65 g recorded before the treatment. This demonstrated that the mass of surface staining material removed was < 0.01 g. No visible traces of the original dark surface stain remained on the artifact following this treatment. However areas of light-yellow stain were noted in less indurated areas of the material, especially on the reverse side (right image, Figure 2). This may have resulted from formation of yellow-colored $FeCl_3$ in the reaction of Cl^{-} (chloride) ions from the HCl with residual Fe^{3+} ions and its retention in the more porous regions of the lithic material comprising this artifact which predominate on the reverse side. A dramatic yellowing of porous ground mass regions of lake-stained Wyboo chert subjected to HCl treatment (Costello 2008) is consistent with this interpretation.

Conversations with Dr. Sam Upchurch (Upchurch 2019a) revealed that he has adopted cleaning agents milder than HCl in order to avoid the risk of dissolving any non-silicified regions of calcite. Upchurch also has explored the multiple forms in which Fe^{3+} ion occurs in deposits, which include ferric hydroxides. We conclude that the presence of Fe^{3+} ion was confirmed in the surface stains removed by HCl treatment, but we can neither identify the specific compounds in which it occurred nor conclude that there were no other components of the stain which were removed.

Although this treatment did not enhance the visibility of surface flaking patterns, it allowed clear visualization of the lithic material, most evident on the obverse side, Figure 3.

Based upon visual inspection of this and other photographs of the subject following cleaning it appeared that SC 583 was manufactured from lithic material exhibiting visual features falling within the range observed for Allendale-Brier Creek chert (Upchurch 1984 and 2019a). Upon examination of the actual point following cleaning, Upchurch concluded that the lithic material is well-silicified and contains fossils typical of those found in chert originating in the Allendale County, SC/Burke County, GA quarry complex (Upchurch, 2019b). This would suggest that SC 583 was manufactured locally from indigenous materials rather than being a non-indigenous point type imported from another region.

Figure 5: FL 409 before (L) and after (R) cleaning with 6M HCl.

Following its cleaning, line drawings of SC 583, Figure 4, were prepared by Darby Erd in order to further document the flaking patterns throughout this artifact. The absence of overshot flaking, an attribute often associated with Clovis technology, is noted. We conclude that removal of surface staining by HCl treatment facilitated visualization of the lithic material composition of SC 583 without either damaging the artifact or preventing clear visualization and documentation of its flaking patterns. Completion of this project is an important step toward entering SC 583 in the permanent archaeological record. Ultimately it will be worthwhile to consider recording three-dimensional scanning data for SC 583 as well as other important South Carolina artifacts for entry into research databases.

The success of this method of chemical treatment on SC 583 led the authors to explore its applicability to Florida artifacts of special interest, i.e., to putative Clovis artifacts recovered from riverine locations in Florida, summarized in the following paragraphs.

As a pilot study, FL 409, a highly stained Clovis preform recovered from the Suwannee River was selected as a subject. FL 409 was so heavily coated as to obscure the chert surface such that any fossils present couldn't be seen - in fact, virtually none of the actual lithic material was visible (Figure 5, left image). Visibility of fossils is critical to identify chert quarry sources in Florida archaeology (Austin et al. 2018). After treatment, most of the heavy surface stain was removed from FL 409 and the lithic material was revealed to be rather porous low-quality chert which exhibited no evidence of thermal alteration, consistent with its prior identification

Figure 6: Chert flake from the Senator Edwards Site, 8MR122.

Figure 7: Prismatic chert blade from Alachua County, FL.

as Clovis (Figure 5, right image). It also was noted that retouch along one edge of FL 409, better visualized in the artifact prior to cleaning (Figure 5: right edge of left image), could be consistent with its use as a knife.

Two samples of unstained Florida chert were employed as control subjects in order to establish that the treatment did not produce observable changes in the lithic material including either generation of false indications of thermal alteration or destruction of such indicators if initially present. One control subject was a large flake of highly corticated chert from the Senator Edwards Site, 8MR122 which exhibited no indication of thermal alteration, Figure 6. The second control subject was a beautiful prismatic chert blade from Alachua County, FL which exhibited colors suggestive of thermal alteration, Figure 7. Neither control sample was qualitatively or quantitatively altered by the cleaning procedure, indicating that evidence of thermal alteration would neither be created nor destroyed by HCl treatment employed in these experiments. Both returned to their original mass values after drying, indicating no loss of material as a result of the treatment.

We conclude from these studies that HCl treatment is a suitable method for removing stain from artifacts recovered from rivers in the Southeastern United States and that this treatment reveals qualitative features of artifact lithic material without altering attributes such as thermal alteration.

Acknowledgements

The authors wish to thank Dr. Sam Upchurch for his comments on lithic artifact cleaning and chert typology. We thank Mr. Darby Erd for creating the line drawing of SC 583 which appears as Figure 4 of this communication. Thanks also to Mr. Kenn Steffy for his comments on point typology and photographic techniques. We would also like to thank Don Munroe for loaning us FL 409 to test the method of stain removal and Dr. Barbara Purdy for providing chert samples from the Senator Edwards site, 8MR122. The late Brian Evenson donated the heat-treated prismatic blade found near the Newnan Lake site area, Alachua County, Florida.

References Cited

Austin, Robert J., Sam B. Upchurch, James S. Dunbar, Richard W. Estabrook, Jon C. Endomino, and Adam M. Burke
2018 The Quarry Cluster Approach to Chert Provenance in Goodyear, Albert C. and Christopher R. Moore, Editors, *Early Human Life on the Southeastern Coastal Plain*. University of Florida Press, Gainesville.

Charles, Tommy and Christopher R. Moore
2018 *Prehistoric Chipped Stone Tools of South Carolina*. Piedmont Archaeological Studies Trust, Glendale, SC. See Figure 2.4 Waisted Haft Area Lanceolate points similar to the Simpson point and Figure 2.5 Expanded-Base Lanceolate points with an absence of fluting.

Costello, Robert C.
2017 Qualitative Chemical Analysis of Surface Stains on a Chert Artifact from Upper Lake Marion, Clarendon County, South Carolina. *South Carolina Antiquities* 49:57-59.
2008 Unpublished research data

Costello, Robert C. and Kenneth E. Steffy
2013 Wyboo Chert and its Prehistoric Utilization. *South Carolina Antiquities* 45:84-86.

Dunbar, James S.
2016 *Paleoindian Societies of the Coastal Southeast*. University Press of Florida, Gainesville. Panels 1 and 2: Mental Templates and a Revised Typology for Florida Paleoindian Points (accessible from the book by QR code scans).

Luedtke, Barbara E.
1992 *An Archaeologist's Guide to Chert and Flint*. Archaeological Research Tools 7. University of California, Los Angeles.

Smallwood, Ashley M., Albert C. Goodyear, Thomas A. Jennings, and Douglas A. Sain
2018 Paleoindians in the South Carolina Coastal Plain: Tracking Pleistocene-Holocene Transitions, in Goodyear, Albert C. and Christopher R. Moore, Editors, *Early Human Life on the Southeastern Coastal Plain*. University of Florida Press, Gainesville.

Steffy, Kenneth E.
2019 Personal communication with the authors 2/24/2019.

Upchurch, Sam
2019a Personal communication with the authors 2/25/2019.

2019b Personal communication with the authors 10/17/19.

1984 Appendix A, Petrology of Selected Lithic Materials from the South Carolina Coastal Plain, in Goodyear, Albert C. and Tommy Charles. *An Archaeological Survey of Chert Quarries in Western Allendale County, South Carolina*. Research Manuscript Series 195. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Wharton, Charles H., Wiley M. Kitchens, and Timothy W. Sipe

1982 The Ecology of Bottomland Hardwood Swamps of the Southeast: A Community Profile, in *Biological Services Program FWS/OBS-81//37 March 1982*. Fish and Wildlife Service, U. S. Department of the Interior.

Seasonal Homes of the Low Country: Three Late Archaic/Woodland Semi-Subterranean Structure at 38BK2091–Rebellion Farms, Berkeley County, South Carolina

Quinn-Monique Ogden

S&ME conducted the fieldwork in the Spring of 2014 at Rebellion Farms, in Berkeley County, South Carolina. This site is composed of multiple occupations ranging from the Middle Archaic period to the early twentieth century. During the excavation in the north-eastern block, we identified the remains of three pithouse structures. These are among the only multiple contemporaneous pithouses found in South Carolina to date. These pithouses, each with a somewhat different pottery assemblage were occupied at different times between the Late Archaic Stallings Phase and the Middle Woodland Deptford Phase. Here is the discussion and interpretation of the similarities and differences in the household assemblages recovered from each house. This study will add to our understanding of household/community design of these time periods.

During 5000–3000 B.P., the Southeastern Late Archaic people came to the coast and riverine regions to settle (Anderson 1996, Schuldenrein 1996:3; Elliot and Sassaman 1995:18). The increasing Late Archaic populations developed new subsistence technology and their social complexity was on the rise (Sanger and Thomas 2010:9). Increasing sedentism, the introduction of soapstone, ceramic vessel technology, and the use of pit storage were new developments in the Late Archaic culture. There is little documentation of Late Archaic structures, due to poor preservation and their ephemeral nature of these feature types (Sassaman and Ledbetter 1996).

Likewise, during Woodland period from 3000-1000 B.P., the transition in eastern North America from the Late Archaic into the Early Woodland is marked by an abrupt change in the settlements, economy, and society on a regional, local and site scale. The Early Woodland is characterized to be less complex in the nature of low population densities, less variety in architectural, burial and artifact types, smaller trade networks (Kidder and Sassaman 2009:681). Throughout the Woodland period, settlement patterns are changing with the development of early agriculture (Cantley and Cable 2002; Trinkley 1989) but there is limited information out there to provide us archaeologists with a picture of the Woodland Coastal Plain settlements.

The discovery of three semi-subterranean structures at Rebellion Farms (38BK2091) gives a glimpse of what Late Archaic and Woodland Coastal Plain structures may have looked like. The Late Archaic and Woodland pottery assemblages within these structural features were in distinctly separate stratigraphic layers leading us to believe these pithouses were occupied at different times between the Late Archaic, the Early Woodland, and the Middle Woodland.

The majority of reported southeastern Late Archaic structures are outlines of post holes or single prepared clay floored structures (Sassaman and Ledbetter 1996). The prepared floors at Rebellion Farms (38BK2091), though very complex due to their ephemeral nature, demonstrate reuse and change throughout the Archaic and Woodland periods. These dwellings reveal a sense of permanence and sedentism. This level of permanence is rare in Late Archaic/Early Woodland habitation sites. The analysis and discussion of these structural features can offer insight to changing lifeways during the Archaic/Woodland transition and will add to understanding of household/community design of these time periods.

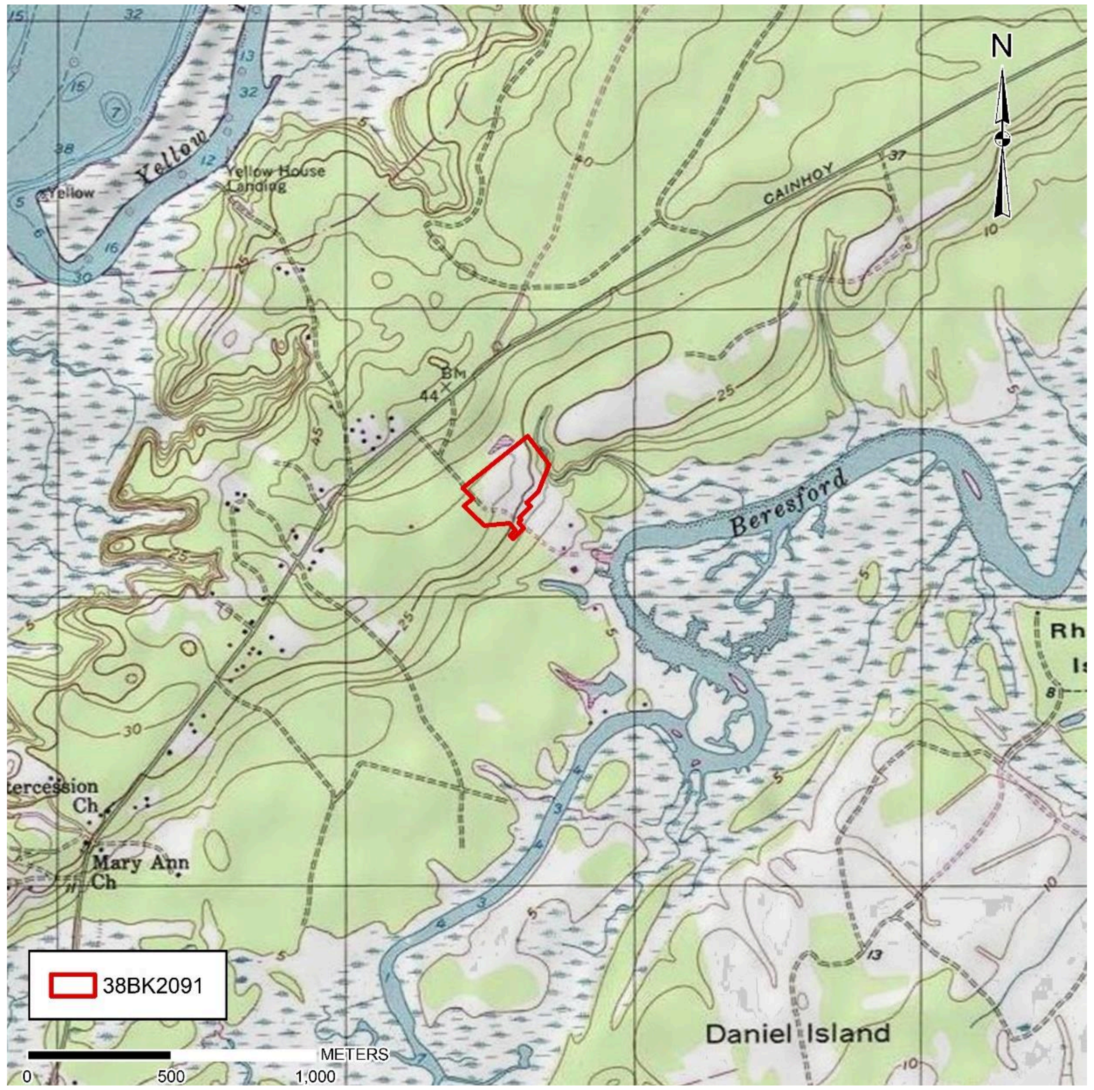


Figure 1: Location of 38BK2091.

Background

The new environmental conditions of marsh and estuarine resources spawned the Late Archaic settlement drive to the coastline (DePratter and Howard 1981; Goggin 1952; Miller 1988; Russo 1998; Thompson 2006; Thompson and Turck 2010; Widmer 1988). The change in the coastal environment was due to sea-level fluctuations (Howard and DePratter 1981; Elliot and Sassaman 1995). Any coastal sites earlier than the Late Archaic were likely inundated by the increased sea level, the Late Archaic coastline is very similar to the coastline now (Colquhoun and Brookes 1986; DePratter and Howard 1981; Gayes et al. 1992). When comparing coastline sites, there are only three Middle Archaic sites, which are severely dwarfed by Late Archaic coastal sites in South Carolina (Anderson 1996). This settlement drives towards the coast suggests the people are coming from the uplands or up from Florida (Turck 2011). Also settlements along rivers and streams began to increase in South Carolina, when sea levels stabilized (Schuldenrein 1996).

The settlement patterns of the Late Archaic were seasonal, where occupations were along major rivers in the spring and summer, and base camps where located along large tributaries during the spring through early fall. In the late fall and winter, the Late Archaic people are thought to go to uplands, living in small, semiautonomous groups (Sassaman et al. 1990).

When looking at the architecture of the Late Archaic in the Southeast, the majority of reported structures are outlines of post holes in a circular or rounded rectangular fashion, or structures with prepared clay floors (Sassaman and Ledbetter 1996). Sassaman (1993) documented at least three Late Archaic structures, at Mims Point near Stalling Island, South Carolina. No prepared floors were discovered at Mims Point, likely due to damage from looting and plowing (Sassaman 1993). Though Sassaman hypothesized there was a semi-circular configuration of structures suggesting a communal space spanning over 200 meters across the site.

Late Archaic prepared rectangular clay floors, measuring approximately 4.5 by 3 meters, have been reported at the Riverton site on the Wabash River in Illinois. (Winters 1969; Sassaman and Ledbetter 1996). These floors have a few associated post holes, and structure was thought to be of a lean-to type of construction or for storage (Winters 1969; Sassaman and Ledbetter 1996). Given this type of construction, these structures were likely used in the warmer months (Winters 1969; Sassaman and Ledbetter 1996).

When researching documented structures in surrounding area of Savannah River Valley, a single stand-alone pithouse, mentioned at Mill Branch (9WR4) in Warren County, Georgia, is the only Late Archaic pithouse documented. The charcoal in the central hearth dated to 3950-3900 B.P. The occupation during Late Archaic was frequent, possibly seasonal, and of a long duration between periods of abandonment and reuse. This lack of other documented pithouses establishes the Rebellion Farms structures as the first instance of multiple Late Archaic/Woodland period pithouses discovered at a single site in South Carolina.

During the end of the Late Archaic (and the onset of the Woodland), sea levels dropped and depopulation of the coastal settlements occurred (Gayes et al. 1992; Thompson and Turck 2009). The Woodland period from 3000-1000 B.P., is known for use of pottery spreading with more styles associated with cultural variability (Cable 1993, Steen et al. 2002). During the Early Woodland (3000-2500 BP), an increase in the sea level drowned the tidal marshes that had provided resources for Thoms Creek and Stallings peoples (Brooks et al. 1989). The successive Refuge peoples are suspected to have splintered and expanded the settlement range in order to take advantage of more diverse environmental settings (Hanson 1982). Groton Plantation also contained a semi-subterranean pithouse, like the structures at Mill Branch and Rebellion Farms but dating to the Early Woodland. This pithouse contained with a central hearth on the Savanah River in Allendale and Hampton Counties, South Carolina, approximately 137 kilometers west of 38BK2091 (Peterson 1971).

In South Carolina, Middle Woodland (2500-1500 BP) occupations are not well documented. Milanich's theory of "seasonal transhumance" describes a possible coastal trend during the Middle Woodland (Milanich 1971, Milanich and Fairbanks 1980). This theory postulates groups moved to the coast during in the winter and summer months and lived in small, semi-permanent villages adjacent to tidal creeks and marshes. From these locations they would fish, gather shellfish, and exploit a variety of other marine and estuarine resources. In the fall, small groups hunted white-tailed deer and foraged for nuts along swamp and marsh terraces (Cantley and Cable 2002; Trinkley 1989). A further increase in agriculture occurred during this period, yielding various crops such as maygrass, goosefoot, knotweed, and sunflower.

In contrast to Milanich's model, one upland site, the G.S. Lewis West site (38AK228) in Aiken County (Sassaman et al. 1990) show evidence of small sedentary population occupying this site year-round. The G. S. Lewis site is a multi-component site that contained a Middle Woodland midden as well as evidence of three or four Deptford structures (Hanson 1982). These structures were roughly circular, had central support posts, and were 4–6 meters in diameter. The primary food source is white-tailed deer, accompanied by alligator, turtle, fish, turkey, freshwater mussels, hickory, and acorns (Sassaman et al. 1990). There were also at least 25 refuse pits and a single burial (Hanson and DePratter 1985). Looking at the big picture of G.S. Lewis and surrounding sites at the Savannah River

Figure 2: Photograph of Block E Planview with the Three Structure Outlines.

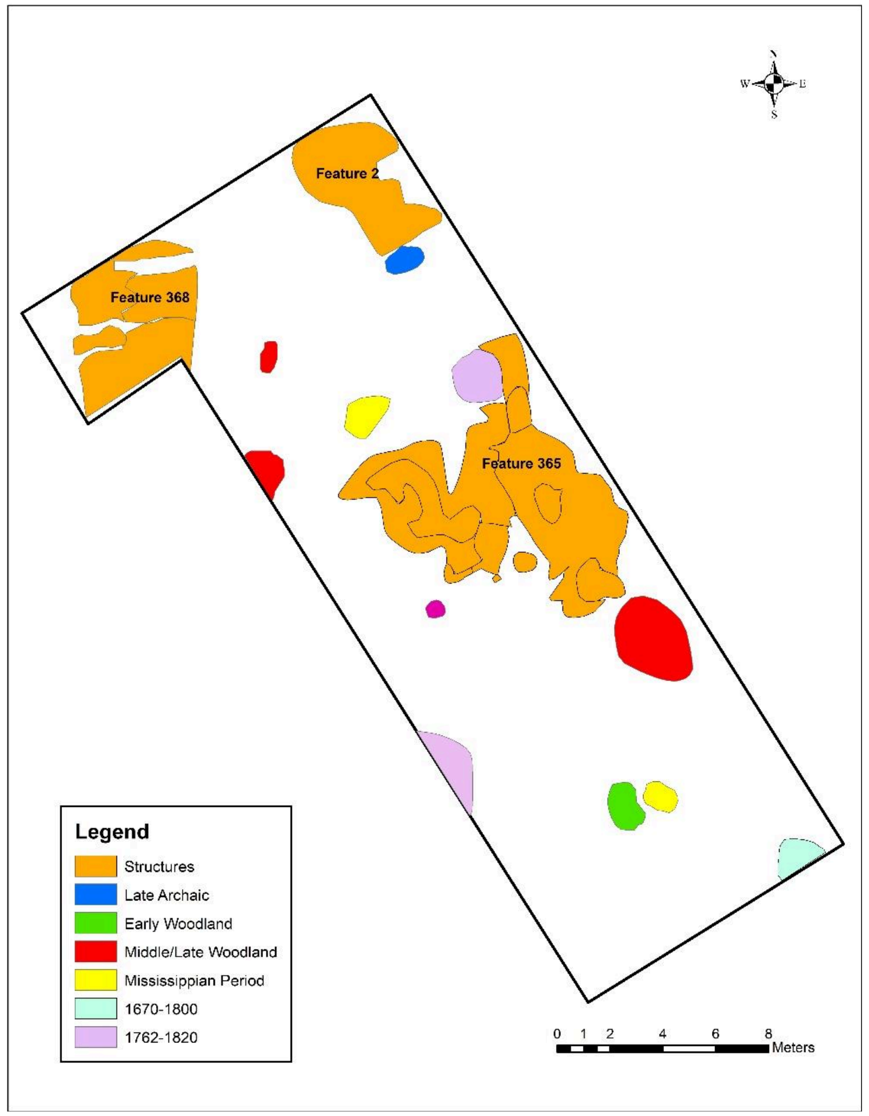


Figure 3: Sketch of Block E Planview with Structures and Features.

Table 1: Pottery Assemblage in the Rebellion Farms Structures.

Pottery Type	Pottery Description	Pottery Decorations	Related Sites/ Reference
Stallings 4500–3000 B.P.	Fiber Tempered Paste	plain, simple stamped, incised, shell punctate, reed punctate, reed drag and jab punctate	(Sassaman et al. 1990)
Thoms Creek 4500–3000 B.P.	Fine Sand Tempered Paste	plain, simple stamped, incised, shell punctate, reed punctate, reed drag and jab punctate	(Sassaman et al. 1990; Sassaman 1993)
Awendaw 3900-2900 B.P.	Fine Sand Tempered Paste	finger pinched, fingernail punctuation, and fingernail gouged decorations	Bass Pond Dam (38CH124), and the Palm Tree Site (38BK147) – (Widmer 1976; Michie 1979; Trinkley 1980)
Refuge 3050-2350 B.P.	coarse sand-tempered in varying degrees	simple stamped, incised, punctated, and plain varieties	Refuge site in Jasper County, SC (DePratter 1979, Sassaman 1993, Williams 1968)
Deptford 2800–1500 B.P.	fine to coarse sandy inclusions in paste	plain, check stamped, linear check stamped, cordmarked, and simple stamped applications	(Caldwell 1943; DePratter 1991; DePratter 1979; Waring and Holder 1968)
Wilmington 1500-1000 B.P.	tempered with grog	cord marking, net impressing, and simple stamped examples	(Anderson et al. 1996; Steen et al. 2002)

Table 2: The Stratigraphic Interpretation within Feature 2.

Munsell Colors	Interpretation	Components
10YR 3/3 Brown	Organic building material and historic disturbance	Stallings, Awendaw, Thoms Creek, Refuge, Deptford, Wilmington, Curvilinear Complicated Stamped sherds, Allendale and Coastal Plain Chert debitage, Quartzite Debitage, Quartz Hammerstones, and a small Savannah River Projectile Point The historic artifacts (brick, coarse earthenware, lead shot, olive green flat glass, and a shoe buckle) were found in the upper 30 cm.
10YR 3/3 with 10YR 4/4 brown	Central Hearth Pit	Refuge
10YR 4/6 dark yellowish brown	Disturbed structural benches or posts during earthquake liquefaction	Not dug separately from other stratigraphy layers
10YR 6/6 brownish yellow	Living Floor	Stallings, Thoms Creek, Refuge, Deptford, Wilmington
10YR 6/8 brownish yellow	Disturbed structural benches or posts during earthquake liquefaction	Not dug separately from other stratigraphy layers
10YR 7/4 very pale brown	Disturbed structural benches or posts during earthquake liquefaction	Not dug separately from other stratigraphy layers
10YR 8/1 white and 10YR 8/2 very pale brown	earthquake liquefaction	No artifacts

Site, Sassaman et al. (1990) suggest a pattern where small villages were occupied on a year-round basis, with smaller outlying sites (e.g., 38LX5) representing seasonally occupied logistical camps.

As for the Late Woodland period (1500-1000 BP), the period is an expansion of Middle Woodland culture. Late Woodland agricultural methods develop further into more elaborate processes. Although when comparing Middle and Late Woodland society and cultures in South Carolina not much change has been documented in their settlement practices (Trinkley 1980).

The pithouses discovered at Rebellion Farms will shed some light of pithouse household design of the Late Archaic – Late Woodland in the Coastal Plain and possibly help archaeologists in the low country to discover more like these subterranean structures in the future.

Excavation Methods

Rebellion Farms is located south of Clements Ferry Rd in Charleston, SC on Nowell Creek historically known as Beresford Creek (Figure 1). The field investigation consisted of mechanically removing the modern plowzone by careful monitoring of a backhoe from five select areas. The field crew then cleaned each excavation block (designated Blocks A-E) by shovel/trowel scraping to identify features and artifact concentrations. The five excavation blocks covered an area of approximately 1,180 square meters and contained a total of 352 subsurface features.

Identified features on the mechanically stripped surface of Blocks A-E were marked with a nail and flagging tape, drawn in plan view, photographed, and recorded with a total station. Unmanned Aircraft System (UAS) or drone was used to photograph each block and large sections of select areas. Each feature was bisected along its longest axis and screened, profiled and feature morphology with cross-section drawings and photographed. Then soil samples were taken determined by feature size and complexity with larger and more numerous samples collected from larger more complex features, we were able to collect 10-liter samples from almost all pits and similar types of deposits. In cases of larger features, we were able to collect both 10-liter and 20-liter samples.

After completing the fieldwork, the artifacts, notes, photographs, maps, and other project-related materials were returned to S&ME's archaeological laboratory in Summerville, South Carolina for processing. Artifacts were washed, accessioned, identified as to function and temporal and/or cultural affiliation as appropriate to project goals, and temporarily curated. All artifacts were returned to the property owner for incorporation into an interpretive display, and made available for future research, at the conclusion of this study. We forwarded two AMS dating samples to Beta Analytic Inc. in Miami, Florida. Beta Analytic conducted Accelerator Mass Spectrometry (AMS) Radiocarbon Dating and calibrated the resulting dates with the 2013 INTCAL program. The results of this analysis are discussed in the Feature 365 section.

Artifact Analysis Methods

Lithic artifacts were identified as either debitage (flakes and shatter) or tools. Debitage was sorted by raw material type. Projectile point identification followed a number of regional typologies (Coe 1964, Oliver 1985, and Sassaman et al. 1990). Prehistoric ceramic artifacts greater than two cm squared were sorted by surface treatment, vessel portion (rim or body), and tempering agents. Where possible, this data was used to place the sherds within established diagnostic types. For this study, we utilize the synthesis by the Diachronic Research Foundation and made available as the Native American Pottery in South Carolina website (http://www.scpottery.com/) as a basis for artifact identification. The three pithouses in Block E contain a variety of pottery assemblages including Stallings, Thoms Creek, Awendaw, Refuge, Deptford, and Wilmington (Table 1).

Excavation of the Rebellion Farms Structures

During the excavation of Block E, we identified the remains of three semi-subterranean structures, Features 2, 365, and 368, the topic of this paper. The discussion of the entirety of the site is too large to focus on in this article. In planview, the

Figure 4: Photograph of Feature 2 Eastern Profile.

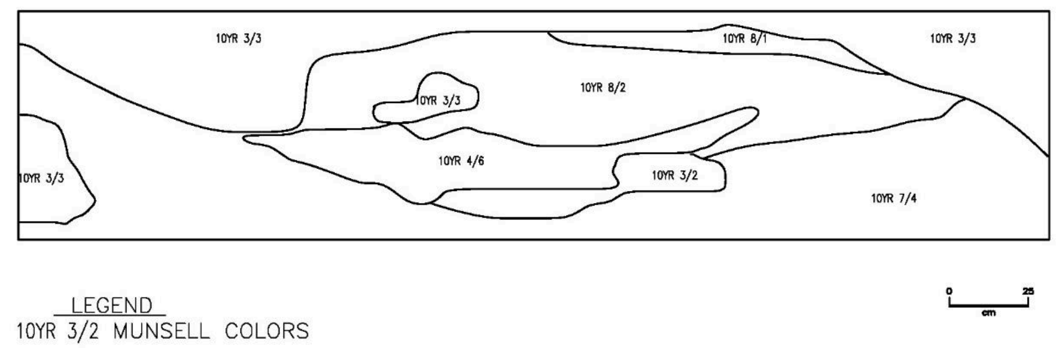


Figure 5: Sketch of Feature 2 Eastern Profile.

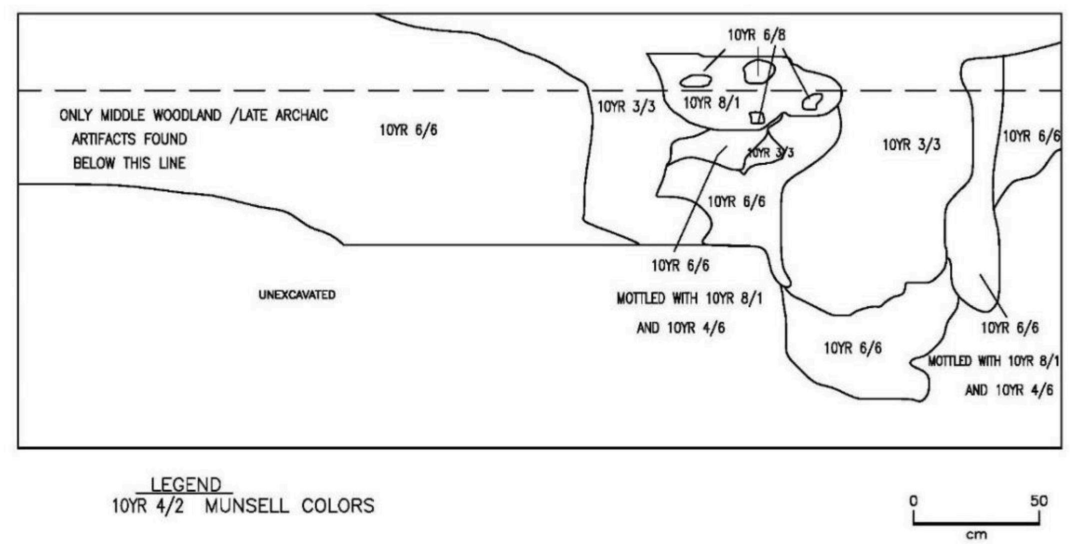


Figure 6: Sketch of Feature 2 West Profile.

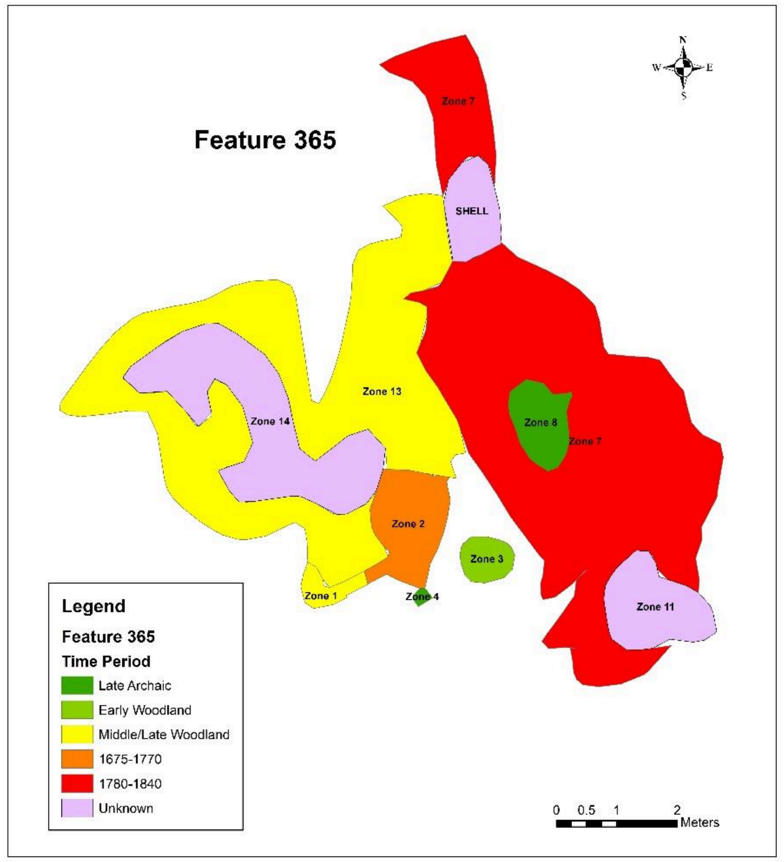


Figure 7: Sketch of Feature 365 Planview with Zones.

Figure 8: Photograph of Feature 365 Northwest Profile of Benched Floor.

structures are overlapping dark stains having diffuse and irregular boundaries with small layer of light-colored fine sand (Figures 2 and 3). Feature 2 in planview was discernible as a large stain with diffuse and irregular boundaries. Feature 365 appears in planview as several overlapping round and rectilinear stains, slightly varied in shape and orientation, located in the center of Block E near the eastern wall.

Feature 368. Feature 368 appeared in planview as a rectilinear stain, with rounded edges and a separate mottled stain surrounding the perimeter. Features surrounding the structures range from Late Archaic to the nineteenth century (Figures 2 and 3).

The pottery assemblages (Table 1) were in distinctly separate stratigraphic layers leading us to believe these pithouses were occupied at different times between the Late Archaic, the Early Woodland, and the Middle Woodland. In broad terms, we interpreted these findings as the remains of Late Archaic occupation with reoccurring occupations throughout the Woodland Period. The continual reuse of the property during the prehistoric and historic periods, in addition to bioturbation and other depositional processes, was evident during the excavation of these features. A large amount of Thoms Creek and Stallings Phase pottery was present in the final stratigraphic layer of these features; some historic items were identified in the plowzone and within the disturbance caused by earthquake liquefaction. This earthquake liquefaction we hypothesize to have occurred sometime after 1770-1800 due to one piece of olive-green bottle glass found within the otherwise sterile earthquake liquefaction soil. Refer to the profile drawings and photographs of Feature 365 (Figures 9 and 12) to see examples of this earthquake liquefaction. At least a third of each structure was excavated. Each structure is discussed individually below.

Feature 2. Feature 2 was initially identified during the evaluation efforts as a mottled stain in the northeast corner of a one x two-meter test unit (Figures 4-6). The placement of Block E was chosen in order to expose this feature and potential surrounding features. After mechanically stripping away the plowzone in Block E, Feature 2 in planview was discernible as a large stain with diffuse and irregular boundaries. Feature 2 measured 460 cm east/west by 550 cm north/south and extended to a maximum depth of 100 cm below the stripped surface.

The first 30 cm of Feature 2 is the result of historic period activities. The undisturbed portion of the feature, extending to a depth of 30 cm below the stripped surface, is the remains of a Middle Woodland structure overlying a pit that contained (Table 2).

Feature 365. Feature 365 appears in planview as several overlapping round and rectilinear stains (Figures 2, 3, and 7) slightly varied in shape and orientation, located in the center of Block E near the eastern wall (Figures 7- 9). Feature 365 was 760 cm east/west and 650 cm north/south and extended to a maximum depth of 140 cm below surface. Exploration of Feature 365 proceeded with the excavation of two perpendicular trenches (Trenches 1 and 2), aligned to crosscut the various diffuse stains; the excavation followed sixteen stratigraphic deposits (Table 3; designated Zones 1-16). The first trench bisected Feature 365 on the east /west axis (Trench 1) (Figures 7 and 8), and began at Zone 1; the other trench, was aligned along a northwest/southeast axis (Trench 2) (Figure 9) and bisected Zone 2/10, a combination of the living floor and a bench or step along the wall (Figure 10).

In summary, the excavation of Feature 365 revealed a basin shaped soil stain, preserved under an earthquake liquefaction or flood deposit, with a clear boundary at the subsoil. This basin shaped stain represents a living floor. The upper portion of the basin-shaped stain had intrusions, in the form of later excavations during the historic period, possible re-use of the structure throughout the Woodland period, bioturbation, and earthquake liquefaction (Figure 7; Table 2). The 40 cm below the stripped surface, capped by the earthquake liquefaction of Zone 8 in the southern portion of Feature 365, contained only Late Archaic period artifacts. Therefore, the earthquake liquefaction layer preserved the Late Archaic occupation of the

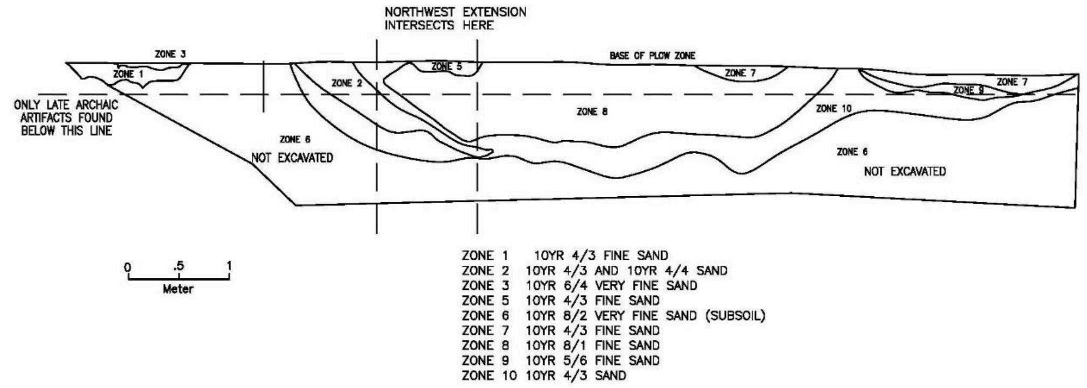


Figure 9: Sketch of Feature 365 Northwest Profile.

Figure 10: Photograph of Feature 365 Northwest Profile of Benched Floor Exposed.

Figure 11: Photograph of Feature 365 Northwest Profile Base of Structure Visible.

Table 3: The Stratigraphic Interpretation within Feature 365.

Zones	**Munsell Colors**	**Interpretation**	**Components**
Zone 1	10YR 4/3 brown fine sand	Refuge refuse Pit with liquefaction deposits (Zone 3)	Historic, Woodland, and Late Archaic periods
Zone 2/10	10YR 4/3 brown with 10 YR 5/4 yellowish brown and 10YR 6/4 dark yellowish brown fine sand	Refuge/Late Archaic Living Floor	Woodland and Late Archaic periods
Zone 3	10YR 6/4 light yellowish brown sand	earthquake liquefaction during or after the Refuge period.	Woodland and Late Archaic periods
Zone 4	10YR 4/4 brown sand	Late Archaic post	Late Archaic period
Zone 5	10YR 4/3 brown sand	overburden or organic structure material	No artifacts associated with this zone
Zone 6	10YR 8/3 very pale brown	Subsoil	No artifacts associated with this zone
Zone 7	10YR 024/3 brown sand	historic lens, not associated with the structure	Historic, Early Woodland, Late Archaic
Zone 8	10YR 8/1 white sand	Earthquake liquefaction or flood deposit	No artifacts associated with this zone
Zone 9	10YR 5/6 yellowish brown sand	Late Archaic prehistoric bench within the structure disturbed by the overlaying historic lens (Zone 7).	Late Archaic period
Zone 11	10 YR 8/1 white sand	Flood or liquefaction deposit	No artifacts recovered
Zone 12		Non-cultural	No artifacts recovered
Zone 13	10YR 4/4 brown mottled with 10 YR 8/1, 10YR 6/4 light yellow brown and 10YR 4/3 brown with 10 YR 5/4 yellowish brown sand	Structural wall bench from the Deptford period, over lapping (zone 2/10) Early Woodland structure, previously used within the Late Archaic, though disturbed historically by Zone 3	Historic, Middle and Early Woodland, Late Archaic periods
Zone 14	10YR 6/6 brownish yellow sand	Subsoil exterior to the structure within the northwestern section.	Prehistoric (lithic debitage present
Zone 15	10YR 10 4/4 dark yellowish brown stain mottled with 10YR 8/1 white and 10YR 8/2 very pale brown sand	Inner Refuge living floor of the trench mixed the outer subsoil and the flood deposit/earthquake liquefaction.	Early Woodland and Late Archaic periods
Zone 16	10YR 4/4 brown mottled with 10YR 3/3 brown and 10YR 8/1 white sand	Disturbed Refuge large post on the exterior north side of the structure.	Historic, Early Woodland, Late Archaic periods

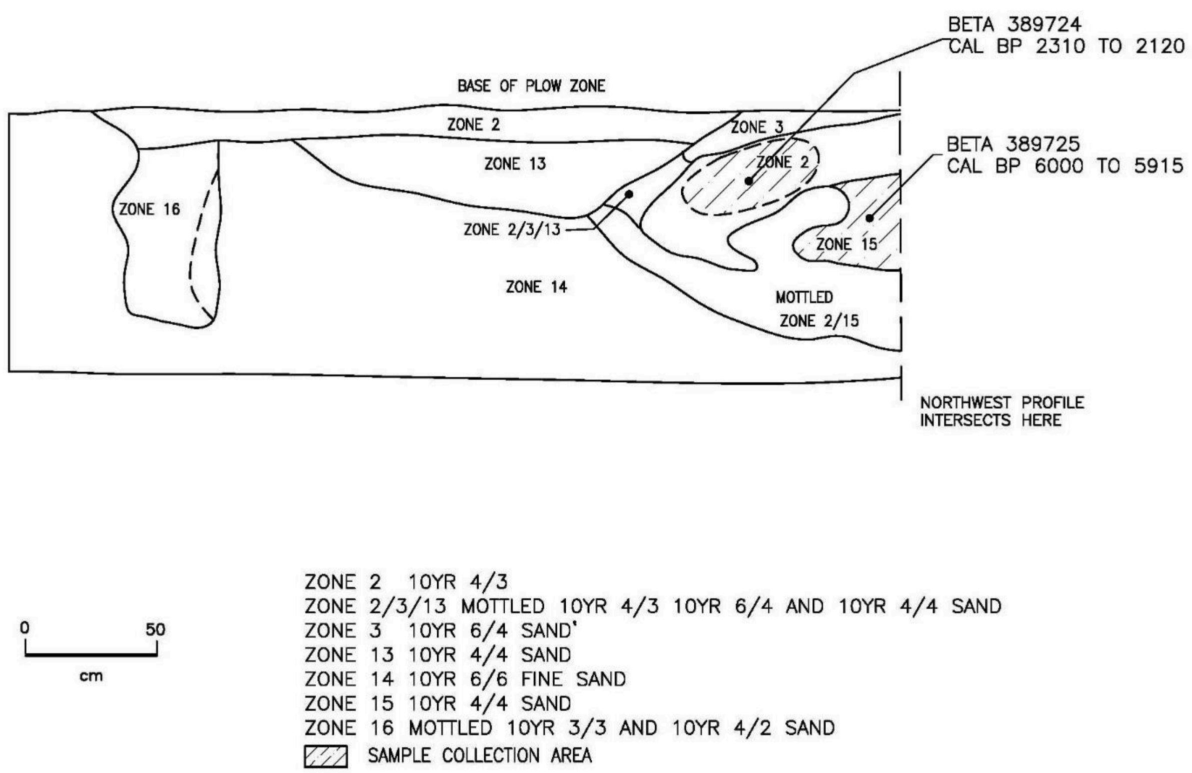


Figure 12: Sketch of Feature 365 Northeast Profile Showing AMS Dates.

structure; the outer and inner trenches, as well as wall benches in the northwestern extension, represent Refuge and Deptford phase occupations (Figure 11).

Two AMS dates were taken from Feature 365 (Figure 12) and sent to Beta Analytic in Miami, Florida. The charcoal samples were taken from the floatation samples of Zone 2 and Zone 15. The sample taken from Zone 2 was from 20–40 cm below the stripped surface, within the northeastern profile of Feature 365's northwest extension. The Zone 2 AMS results showed a measured radiocarbon age of 2180+/-30 B.P., a conventional radiocarbon age of 2190+/-30 B.P., and a 2 Sigma Calibration of Cal BC 360 to 170 (Cal BP 2310 to 2120). The Zone 15 sample was collected at 20–65 cm below the stripped surface, within the northeastern profile of Feature 365's northwest extension. The Zone 15 AMS results showed a measured radiocarbon age of 5210+/-30 B.P., a conventional radiocarbon age of 5220+/-30 B.P., and a 2 Sigma Calibration of Cal BC 4050 to 3965 (Cal BP 6000 to 5915).

These dates were unexpected, given the temporal indicators of Refuge, Thoms Creek, and Stallings phase ceramics within these sample areas, which correspond to the Early Woodland and Late Archaic periods. The sigma calibration date of Zone 2 of Cal BC 360 to 170 (Cal B.P. 2310 to 2120) falls in Middle/Late Woodland Period. The sigma calibration date of Zone 15 of Cal BC 4050 to 3965 (Cal B.P. 6000 to 5915) falls into Middle Archaic Period.

There are several possibilities for the cause of these unanticipated dates. The Zone 2 sample area was adjacent to Zone 3, the liquefaction/flood deposit, as well as the later structural bench of the Zone 13 deposit. Either of these deposits could have disturbed the sample area. Zone 13 contained Deptford Pottery, suggesting that the AMS date may represent where Zone 2 and Zone 13 overlap. The Zone 15 sample area was taken very close to

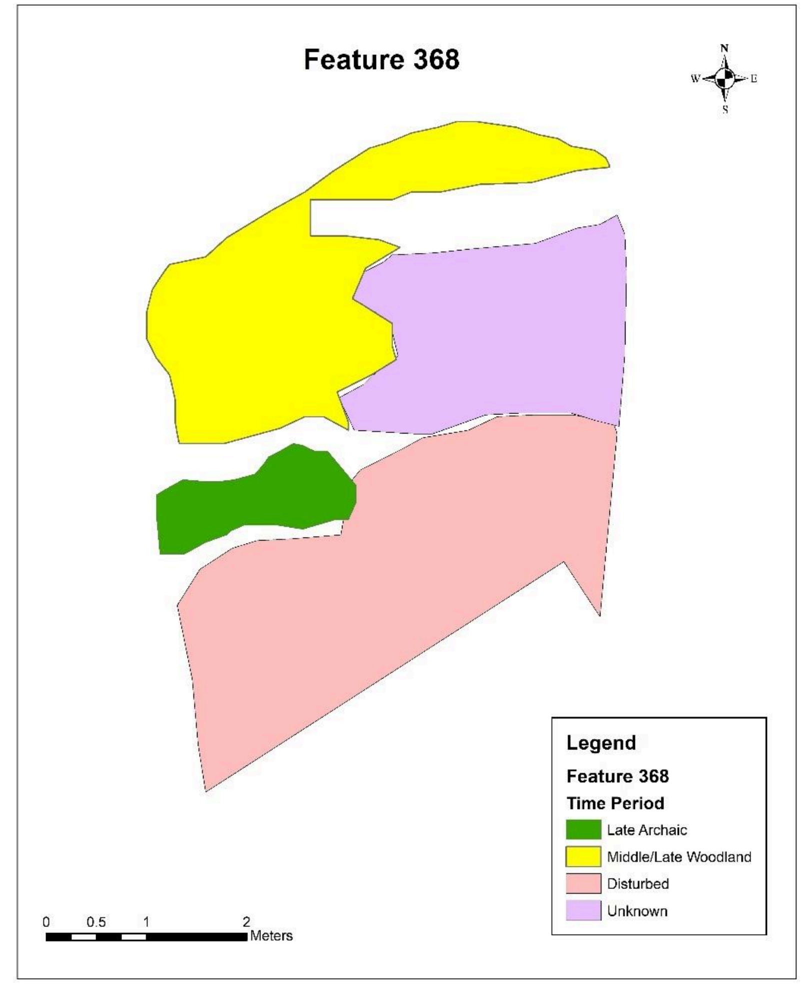


Figure 13: Sketch of Feature 368 Planview with Zones

the outside of the feature directly adjacent to the Zone 3 (Refuge deposit/liquefaction deposit), Zone 8, the liquefaction deposit, Zone 6, and the subsoil. The Zone 15 AMS date possibly might represent the organics brought in by Zone 8, the liquefaction deposit, and/or Zone 6, the subsoil. Also, the charcoal from the floatation samples may come from anywhere within the zone and dated any of the roots or organics deposited in the feature zones throughout time. In summary, the error in the collection processes and placement of the soil samples for AMS dates is likely the major cause for these questionable dates. However, the dates of Feature 365 structure indicate the occupation was between the dates of the Middle Woodland period (Cal BC 360 to 170 (Cal B.P. 2310 to 2120)) to the Middle Archaic period (Cal BC 4050 to 3965 (Cal B.P. 6000 to 5915)), which is a helpful timeline.

Feature 368. Feature 368 appeared in planview as a rectilinear stain, with rounded edges and a separate mottled stain surrounding the perimeter (Figures 13-15). The feature measured 340 cm east/west by 320 cm north/south, however the structure extends into northern and southern walls of the excavation block; Feature 368 had a maximum depth of 65 cm below the stripped surface. Exploration of Feature 368 proceeded with the excavation of two perpendicular 1x2 meter units. The field crew dug this feature in 10-centimeter levels arbitrarily for the upper 33 cm; therefore, the stratigraphic layers cannot be defined into separate time period components. Zones were established after 33 cm, although these zones were only separated into general areas within excavation units, not by stratigraphic layers. The first 33 cm of Feature 368 was a mottling of 10YR 4/2 dark

Figure 14: Photograph of Feature 368 North Profile.

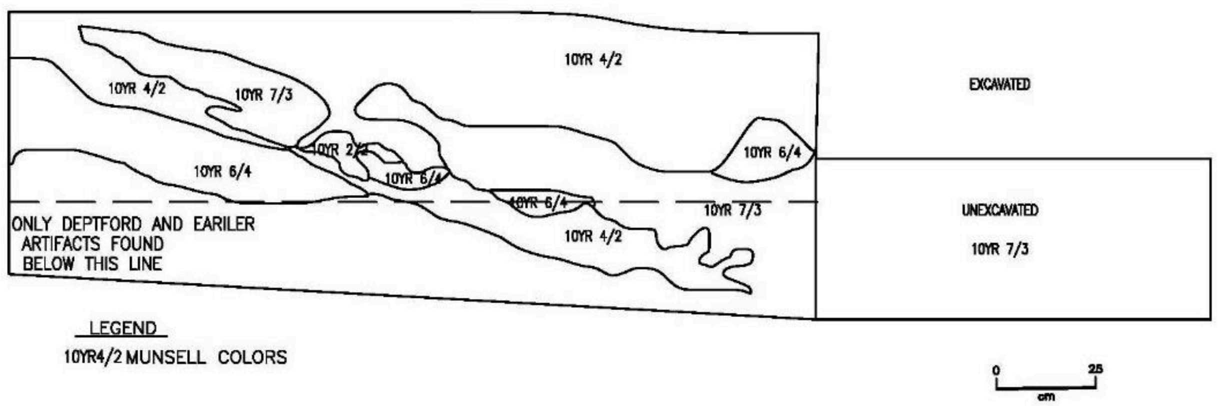


Figure 15: Sketch of Feature 368 North Profile.

grayish brown sand, 10YR 2/2 very dark brown sand, 10YR 6/4 light yellowish brown sand, and 10YR 7/3 very pale brown sand. The 10YR 4/2 brown stain started at the stripped surface as a rounded rectangular stain with mottling of 10YR 6/4 light yellowish brown sand and 10YR 7/3 very pale brown. The shape of this mottled feature in plan, at 30 cm deep, displayed several mottled irregular shaped basins, one oblong shaped basin extending from the north profile, and the two diffuse circular basins extending from the south profile. The upper 33 cm of Feature 368 is interpreted as several overlapping cultural and natural features, which cannot be discerned from each other due to their diffuse overlapping boundaries. The components of Feature 368 below 33 cm were split off into 4 zones described in the following paragraphs (Table 4).

Interpretation of Structures

Features 2, 365, and 368 are the first multiple Early Woodland/Late Archaic pithouses at a single site found in South Carolina. Multiple Early Mississippian pithouses were located at the Riverfront Village (38AK933) in Aiken County, South Carolina, however those date from a later time period (Whitley 2013). Given the large size of the structures, and the artifacts found within and around these structures, they most likely functioned as a dwelling for a nuclear or extended family. Other similar structures have been recorded at the Mill Branch site (9WR4) in Georgia and the G.S. Lewis West Site (38AK228) in South Carolina, although they were not multiples. A single stand-alone pithouse, mentioned at Mill Branch (9WR4) in Warren County, Georgia, is the only Late Archaic pithouse documented in the Southeast. The Mill Branch site (9WR4) is most notable for the Late Archaic midden pithouse with a central hearth. The charcoal within the central hearth at 9WR4 dated to 1950–1900 BC. The Mill Branch site (9WR4) also had a post mold concentration in a sub rectangular or oval pattern, measuring 4 meters by 8 meters, associated with an Early Woodland Refuge structure (Sassaman and Ledbetter 1996). Groton Plantation also contained a semi-subterranean pithouse Refuge structure with a central hearth on the Savanah River in Allendale and Hampton Counties, South Carolina, approximately 137 kilometers west of 38BK2091 (Peterson 1971).

The G. S. Lewis site (38AK228), is a multi-component site that contained an extensive Deptford midden as well as evidence of three or four Deptford structures (Hanson 1982). These structures were roughly circular, had central support posts, and were 4–6 meters in diameter. Both the Mill Branch and the G. S. Lewis sites appear to have been occupied year-round (Hanson 1982; Sassaman et al. 1990). The structures at these sites were roughly the same size (approximately 4 meters to 8 meters in diameter) and shape as the one found at Rebellion Farms and they also appear to be domestic in nature (Sassaman and Ledbetter 1996; Hanson 1982).

Overlapping pithouses, similar to Rebellion Farms, have been documented at Davison Site in Middlesex County, Ontario, Canada. The two overlapping Late Archaic/Early Woodland pithouses at the Davison Site date to ca. 3000 BP and 2800 BP (Ellis et al. 2010). These pits were roughly circular and approximately 5 meters in diameter. Ellis and his collaborators mention the feature dates could be wrong, due the overlapping deposit, and that these overlapping structures would be only the second, well-documented complex in eastern North America -- the only other definitive Late Archaic pithouse being from the Mill Branch site in Georgia, mentioned earlier.

Like the flood or liquefaction at Rebellion Farms, at the Davison site the pithouses were actually built on top of the last flood event that had filled the interior of the earlier pithouse. Construction of the later houses had cut into and removed the top edge of the pithouse in some portions. Ellis and colleagues (2010:5) describe the problem with excavating these types of pithouses accurately:

> On a site such as this, occupied for over a thousand years, subsequent occupants would use any existing natural or cultural depression to dispose of garbage as well as the earth they derived from digging new pits, houses and other features. They could

actually dig up earlier artifacts and end up depositing those earlier artifacts along with their own debris into other features. In addition, these kinds of houses also often have soil or sod roof coverings and one could incorporate accidentally earlier debris when collecting soil to cover the structure. Later the roof could collapse incorporating earlier debris into the later deposits.

As Ellis outlines above, the struggle of digging these pithouses is knowing exactly how to divide and classify certain components of the structure. The solid conclusion about these Rebellion Farms pithouse structures is that the structures were produced at some point in the Woodland period and built upon a Late Archaic occupation. At some point after the Late Archaic, a major natural occurrence (or several occurrences) caused a very pale brown/white deposit to infill and disturb these structures. This natural occurrence caused the intermixing of artifacts within the deposits of the structures.

The Rebellion Farms Late Archaic/Woodland structures tell a story of a community reused throughout time. These dwellings had organic roofs and dug out living floors, demonstrating a degree of permanence/sedentism, and small nuclear families were living in these subterranean dwellings in the spring or fall. This level of permanence is not usually seen in Late Archaic/Early Woodland habitation sites.

Pithouses, in general, represent a degree of sedentism. These pithouses were of high permanence, due to large wall posts, prepared floors, and large labor investments; the settlement permanence of pithouses defies the usual archaeological notion of mobility and flux associated with prehistoric hunter gatherers (Sassaman and Ledbetter 1996:76). As Sassaman and Ledbetter discuss, "A long period continuously settled camp may have long term residents, newcomers, and short-term visitors (and) use of structures and domestic space will depend on social relations of newcomers and visitors to residents" (1996:76). This may be the reason for such a variance of pottery in these structures. Sassaman and Ledbetter (1996) also state, "Winter camp(s) occupied for twenty years with the same population of people may involve structures designed to no more than two seasons due to the changes in interpersonal relations affecting co resident composition, household size sharing, and cooperation in the interhousehold" (1996:76). The indeterminable boundaries of these Rebellion Farms structures could represent these many changes of reoccupation over time.

Like contemporaneity, seasonality is hard to determine at this pithouses, due to lack of seasonal indicators. Bentz (1988) hypothesized that open structures were warm weather dwellings of single families and enclosed structures were used by multiple families in the cold. If this is the case, it appears that Feature 2 was a cold weather house for a small family, whereas Features 365 and 368 were warm weather homes, due to their lack of central fires. Sassaman and Ledbetter (1996:94) postulate a four to six-meter maximum dimension of structures that represent nuclear families. It is possible that the pithouse with the fire may not have been a winter home, but a home during the rainy season. Sassaman and Ledbetter (1996:94) infer this from ethnographic research in the Congo; the tribes there have interior heaths in their dwelling during the frequent rains. As for the layers of flood deposits, flooding episodes were documented through the southeast at other structures of the same time periods. All structures mentioned in this paper have had a layer of flood deposits. As Sassaman and Ledbetter point out, late winter and spring flooding would stop year-round floodplain structures (1996:83-85). Therefore, these structures at Rebellion farms were likely summer and fall dwellings.

As for community design, this site, at the very least, was reused for a long period of time and these structures were likely occupied seasonally. The ethnographic research of Sassaman and Ledbetter indicates close spacing of small structures along the Middle Savannah River may represent short term occupation, like African tribe of Efe (1996:91). Sassaman and Anderson (2004:108) document circular villages, with small four to five-meter, posthole outlined structures at Stallings Island and

Table 4:The Stratigraphic Interpretation of Feature 368.

Zones	Munsell Colors	Interpretation	Components
Zone 1	10YR3/2 very dark grayish brown sand 10YR4/2 dark grayish brown sand, 10YR 2/2 very dark brown sand, 10YR 5/3 brown sand, 10YR 5/4 yellowish brown sand, 10YR 6/4 light yellowish brown sand, 10YR 7/3, 10YR 8/2, and 10YR 8/3 very pale brown sand	Disturbed Deptford structural bench	Historic, Woodland, Archaic
Zone 2	10YR 4/2 dark grayish brown sand	Historic pit for refuse postdating Zone 1 Zone 2, and Zone 4	Historic, Woodland, Archaic
Zone 3	10YR 6/3 pale brown sand	Diagonally leaning prehistoric post with historic shell pit disturbance or a tree	Historic, Woodland, Archaic
Zone 4	10YR 6/4 light yellowish brown sand.	Late Archaic feature disturbed by Zone 2	Late Archaic

two other sites within two kilometers of the island. These circular villages are estimated to have been occupied after 2250 BC and had a population of 90 or 100. Further excavation would be needed to prove if there was a village complex at Rebellion Farms, but it is possible, based on the spacing and placement of the three structures. As for Early Woodland community living, residential groups were slightly smaller than the Stallings Culture, no more than a population of 50 (Sassaman and Anderson 2004:113). The Early Woodland people were fairly mobile foragers, maybe seasonally sedentary, and their social organization was unranked or minimally ranked (Sassaman and Anderson 2004:113). Widely shared material traits within regional traditions, and the blurred boundaries that separate them, attest to open relations (Sassaman and Anderson 2004:113); however, in the Early Woodland period, there was a decline in interregional exchange and non-local materials (Sassaman and Anderson 2004:113). Rebellion Farms has qualities associated with a village, seemingly structural communities with well-defined structures, large subterranean storage pits, and dense occupational middens, like the Kellogg Phase in Northwest Georgia (Sassaman and Anderson 2004:113).

Conclusion

The Rebellion Farms Late Archaic/Woodland structures tell a story of a community reused throughout time. These dwellings had organic roofs and dug out living floors, demonstrating a degree of permanence/sedentism, and small nuclear families were living in these subterranean dwellings in the spring or fall. This level of permanence is not usually seen in Late Archaic/Early Woodland habitation sites. These types of structural features are likely more common but there are hard to find. Lack of preservation, lack of knowledge of what to look for, and the small scale of most excavations are the likely causes for these types of features not being found at Late Archaic and Woodland sites.

Acknowledgements

I would like to thank Rebellion Farms Holdings, LLC for being accommodating of the research on this site. I also thank Aaron Brummitt, RPA, who served as the Principal Investigator, the field staff of Donna Bryant; Heather McAllister; Patrick H. Morgan, RPA; Jeremy C. Miller; Sarah Posin, RPA; Sarah Sheehan; and Kimberly Stahl. Landmark Construction, Inc. provided the earthmoving equipment and operator to assist in the excavation.

References

Anderson, David. G.

1996 Models of Paleoindian and Early Archaic Settlement in the Lower Southeast. In D.G. & K.A. Sassaman (Eds.) *The Paleoindian and Early Archaic Southeast* (pp. 28-47) University of Alabama Press, Tuscaloosa.

1975 Inferences from Distributional Studies of Prehistoric Artifacts in the Coastal Plain of South Carolina. *Southeastern Archaeological Conference Bulletin* 18:180-194.

Barry, J. M.
1980 *Natural Vegetation of South Carolina*. University of South Carolina Press, Columbia.

Bentz, Charles
1988 The Bailey Site: Archaic, Late Woodland, and Historic Settlement and Subsistence in the Lower Elk River Drainage of Tennessee. Report submitted to Tennessee Department of Transportation, Project 28004-0241-94. Department of Anthropology, University of Tennessee, Knoxville.

Brooks, Mark J., Peter A. Stone, Donald J. Colquhoun, and Janice G. Brown
1989 Sea Level Change, Estuarine Development and Temporal Variability in Woodland Period Subsistence-Settlement Patterning on the Lower Coastal Plain of South Carolina. In *Studies in South Carolina Archaeology*, edited by Albert C. Goodyear III and Glen T. Hanson, pp. 19-52. The University of South Carolina Institute of Archaeology and Anthropology Anthropological Studies 9, Columbia.

Cable, John S.
1993 *Prehistoric Adaptations to the Interior Uplands Environment of the South Carolina Coast II: Test Excavations at Twelve Sites in the Francis Marion National Forest*. New South Associates. Stone Mountain, Georgia.

Colquhoun, D. J., and Mark J. Brooks
1986 Evidence for Eustatic Components in Late Holocene Sea Levels. *Geoarchaeology* 2:275-291.

DePratter, Chester and Howard, J.D.
1981 Evidence for a sea level lowstand between 4500 and 2400 years B.P. on the southeast coast of the United States. *Journal of Sedimentary Petrology* 15:1287-1295.

Elliott, Daniel T., and K. E. Sassaman.
1995 *Archaic Period Archaeology of the Georgia Coastal Plain and Coastal Zone*. University of Georgia Laboratory of Archaeology Series Report 35. Athens.

Ellis, Christopher, Edward Eastaugh and Jim Keron
2010 A Preliminary Report on a Late Archaic Pithouse from the Davidson Site (AnHk-54) *Kewa.* 10-6 and 10-7:1-12.

Kidder, T.R., and Kenneth Sassaman
2009 The view from the Southeast. In T.E. Emerson and D.L. McElrath (Eds.) *Archaic Societies: Diversity and Complexity Across the Midcontinent* (pp.667-694) Albany: SUNY Press.

Kovacik, C. F., and J. J. Winberry
1987 *South Carolina: The Making of a Landscape*. University of South Carolina Press, Columbia.

Gayes, P.T., Scott, D.B. Collins, E.S., and Nelson, D.D.
1992 A late Holocene sea-level fluctuation in South Carolina. Quaternary Coasts of the United States: Marine and Lacustrine systems, *SEPM special publication* 48:155-160.

Goggin, J.
1952 *Space and Time Perspectives in North St. Johns Archaeology Florida*. New Haven: Yale University.

Hanson, Glen T. Jr.
1982 The Analysis of Late Archaic- Early Woodland Adaptive Change Along the Middle Savannah River: A Proposed Study *Notebook* 14:1-38 South Carolina Institute of Archaeology and Anthropology, The University of South Carolina. Columbia.

Peterson, Drexel
1971 *Time and Settlement in the Archaeology of Groton Plantation, South Carolina*. Harvard University.

Milanich, G.T.
1994 *Archaeology of pre-Columbian Florida*. Gainesville: University Press of Florida.

Milanich, G.T. and Charles Fairbanks
1980 *Florida Archaeology*. New York: Academic Press.

Miller, J.J.
1988 *An Environmental History of Northeast Florida*. Gainesville: University Press of Florida.

Russo, Michael
1991 *Archaic Sedentism on the Florida Coast: A Case Study from Horr's Island*. PhD. Dissertation. Department of Anthropology, Gainesville: University Press of Florida.
1992 Chronologies and Cultures of St. Marys Region of Northeast Florida and Southern Georgia. *The Florida Anthropologist* 45(2):107-126.
1998 Measuring Sedentism with Fauna: Archaic Cultures Along the Southwest Florida Coast. In T. R. Rocek and O. Bar-Yosef (Eds.) *Seasonality and Sedentism: Archaeological Perspectives from Old and New World Sites* (pp. 143-164). Cambridge, MA: Peabody Museum.

Sanger, M.C., and Thomas, D.H.,
2010 The Two Rings of St. Catherines Island: Some Preliminary Results from the St. Catherines and McQueen Shell Rings. In D. H. Thomas and M.C. Sanger (editors), *Trend, Tradition and Turmoil: What Happened to the Southeastern Archaic?*, Anthropological Papers of the American Museum of Natural History, No. 93:45–70. New York: American Museum of Natural History.

Sassaman, Kenneth E.
1993 *Early Pottery in the Southeast: Traditions and Innovation in Cooking Technology*. Tuscaloosa: University of Alabama Press.

Sassaman, Kenneth E., Mark J. Brooks, Glen T. Hanson, and David G. Anderson
1990 *Native American Prehistory of the Middle Savannah River Valley. Savannah River Archaeological Research Papers 1*. Occasional Papers of the Savannah River Archaeological Research Program. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Sassaman, Kenneth E. and David G. Anderson
2004 Late Holocene Period, 3750 to 650 B.C. In *Southeast Volume, Smithsonian Handbook of North American Indians*. Edited by Raymond D. Fogelson, pp. 101-114. Smithsonian Institution, Washington, D.C.

Sassaman, Kenneth E. and R. Jerald Ledbetter
1996 Middle and Late Archaic Architecture. In *Archaeology of the Mid- Holocene Southeast*. Edited by Kenneth Sassaman and David G. Anderson, pp. 75-95. University of Florida, Gainesville.

Schuldenrein, J.
1996 Geoarchaeology and the mid-Holocene landscape history of the greater Southeast. In K.E. Sassaman and D.G. Anderson (editors), *Archaeology of the mid-Holocene Southeast*. pp. 3–27. Gainesville: University Press of Florida.

Steen, Carl, James Legg, Sean Taylor and Ashley Chapman
2002 *The MEHRL Project: Archaeological Investigations at the Hollings Marine Laboratory Fort Johnson, Charleston South Carolina*. The Diachronic Research Foundation. Columbia.

Thompson, Victor D.
2006 *Questioning Complexity: The prehistoric Hunter-Gatherers of Sapelo Island, Georgia*. PhD. dissertation, Department of Anthropology, University of Georgia, Athens.

Thompson, Victor D. and John Turck
2010 Island archaeology and the Native American Economies of the Georgia Coast. *Journal of Field Archaeology* 35(3):283-297.
2009 Adaptive cycles of coastal hunter-gatherers. *American Antiquity* 74(2):255-278.

Turck, John A.
2011 *Geoarchaeological Analysis of Two Back Barrier Islands and Their Relationship to the Changing Landspace of Coastal Georgia*. PhD. dissertation, Department of Anthropology, University of Georgia, Athens.

Trinkley, Michael
1980 *Investigation of the Woodland Period Along the South Carolina Coast* PhD. Dissertation, Department of Anthropology, University of North Carolina Chapel Hill.
1989 Archaeological Overview of the Woodland Period: It's the Same Old Riddle. In *Studies in South Carolina Archaeology*, edited by Albert C. Goodyear III and Glen T. Hanson, pp. 19-52. South Carolina Institute of Archaeology and Anthropology Anthropological Studies Research Manuscript Series 9, The University of South Carolina, Columbia.

Watts, W. A.
1980 Late Quaternary Vegetation History at White Pond on the Inner Coastal Plain of South Carolina. *Quaternary Research* 10.
Whitley, Thomas
2013 *Archaeological Data Recovery at Riverfront Village (38AK933): A Mississippian/ Contact Period Occupation*. Prepared by Brockington and Associates, Inc. Prepared for David and Floyd. Greenwood, South Carolina.
Widmer, R. J.
1988 *The Evolution of the Calusa: A Non-Agricultural Chiefdom on the Southwest Coast of Florida*. Tuscaloosa: The University of Alabama Press.
Winters, H.
1969 *The Riverton Culture*. Springfield: Illinois State Museum.

Evaluating Kirk Corner Notched Resharpening Trajectories through Experimental Archaeology

Joseph E. Wilkinson

Archaeological studies of the Early Archaic cultural period in the lower Southeastern United States have consistently recognized the high degree of mobility among hunter-gatherers following the end of the last great Ice Age, and have continued to evaluate the curated toolkits within these highly mobile settlement systems. Many such studies have relied on the evaluation of these transported toolkits away from the sources of lithic raw material where they originated. Distance and direction from these sources are often cited as a meaningful evaluation of mobility and subsistence strategies, and such studies often rely on aggregate evaluations of assemblages due to the lack of isolated occupational and behavioral residues. Such aggregate evaluations are useful for overall patterning within these systems, but much about individual behaviors on sites is minimized through such evaluations.

This paper attempts to emphasize and evaluate the importance of singular behavioral residues, such as hafted biface resharpening, with an experimental approach in order to shed some light on the overall use-life of a Kirk corner notched hafted biface within such a mobile settlement system. This evaluation will aid in identifying such residues on sites for interpretation regarding site function, as well as aid in modeling predictions of technological capabilities within Early Archaic settlement systems. The primary interests of this experiment are to 1) identify the average number of resharpening events Kirk corner notched hafted bifaces can withstand, 2) evaluate the physical changes that the Kirk bifaces exhibit from such resharpening, and 3) evaluate the nature and characteristics of the resulting debitage such that the visibility of these residues in archaeological assemblages might be more easily identified and evaluated.

Background

Kirk corner notched hafted bifaces (hereafter referred to as Kirks for simplicity) are a commonly identified stylistic mode across the Eastern United States, with sub-varieties exhibiting numerous traits but all sharing in a distinctive corner notching method of manufacture (Coe 1964; Daniel 1996, 1998, 2001; Justice 1987; Smith 1995; Tuck 1974). Within the lower Southeast, Kirks were first defined and described by Joffre Coe (1964) in the lower Piedmont of North Carolina, where he excavated Kirks in situ in Early Archaic stratigraphic layers. According to Coe's findings, Kirks descended from Palmer corner notched hafted bifaces, but preceded Kirk stemmed hafted bifaces. Since Coe's foundational work , archaeological studies have further evaluated Kirks and substantiated this temporal placement, and have determined an age range of approximately 9400-8800 years before present (Anderson and Sassaman 1996; Broyles 1971; Cable 1996; Claggett and Cable 1982; Chapman 1985; Daniel 1996, 1998, 2001; Justice 1987; Kimball 1992, 1996; Sassaman et al. 2002; Tuck 1974; White 2012, 2016a, 2016b).

Much has been learned about Kirk technological organization from intensive studies of excavated assemblages. Within South Carolina, perhaps the best excavated Kirk assemblage evaluated to date is the G.S. Lewis East Site (38AK228) (Sassaman et al. 2002). This assemblage is a rich and isolated Kirk occupation along the Savannah River in Aiken County, where numerous Kirk hafted bifaces and tools were found. It is isolated in the sense that no other Early Archaic occupations appear to be present on the site. The G.S. Lewis East Kirk assemblage appears to represent an intensive multi-household occupation with enough integrity to infer potential structures and activity areas. Daniel

(2002) evaluated the Kirks from this assemblage and noted their varied conditions were a result of attrition from use and resharpening. In fact, Daniel (2002:49) proposed three stages of their use-life based on their relative conditions of resharpening/reconditioning. His proposed early stage exhibits larger blade lengths with straight to excurvate blade margins and acute tip angles; his intermediate stage is exhibited by acute tip angles, bifacial serrations, and moderate length blades; and his late stage exhibits obtuse tip angles, shorter blade lengths and straight to recurvate blade margins, and moderate to significant blade attrition. His proposed use-life trajectory indicates that as blade length decreases, tip angle increases, along with increased attrition (Daniel 2002: Figure 3-4).

Further understanding of Kirk technological organization has been gleaned from landscape evaluations of mobility and subsistence. Evaluations of Early Archaic mobility and subsistence in South Carolina and the lower Southeast have often relied on aggregate evaluations of assemblages, often utilizing surface collections to evaluate large scale patterns (Anderson and Hanson 1988; Anderson and Schuldenrein 1983; Charles and Moore 2018; Daniel 1996, 1998, 2001; Goodyear 2014; Sassaman 1996; Sassaman et al. 1988; Wilkinson 2017a, 2017b, 2018). Throughout these evaluations, some attention has been given specifically to the corner notch mode of Kirk, and have identified both the abundance of Kirks across the South Carolina landscape, as well as their consistent long distance transport (Daniel 1996, 1998, 2001; Sassaman 1996; Sassaman et al. 1988; Wilkinson 2017a, 2018). Of note, Daniel's (1996, 1998, 2001) evaluations led to the proposal of the Uhwarrie-Allendale Macroband model for explaining the long-distance movement of high quality lithic raw materials and the societal structures that may have produced such patterns. Daniel proposed that Early Archaic social groups, specifically those making and using Kirks, were technologically tethered to the high quality lithic raw material sources of Uhwarrie mountains rhyolites, and Allendale coastal plains cherts. This technological tethering was proposed as the basis around which people organized their mobility and subsistence practices and negotiated other resources. Daniel believed this organization also influenced social organization and practices.

Few attempts have been made to evaluate the use-lives of Kirks here in South Carolina based on data from excavated assemblages (Daniel 2002; Sassaman et al. 2002) whereas only recently studies have attempted to evaluate changes in Kirk biface conditions across the landscape as it relates to the embedded behaviors of a highly mobile settlement system (Wilkinson 2017a). Some attention has been given to the stylistic variability of Kirks found here (White 2016b), as well as the technological variability Kirks exhibit especially relative to preceding side notched bifaces (White 2019).

However, extending outside of South Carolina studies, there are additional examples of archaeological evaluations of biface reconditioning and resharpening relevant to the present study. Perhaps the earliest evaluation of biface resharpening is found in Goodyear's (1974) evaluation of Dalton resharpening in Arkansas. This work focused on the interpretation of the Dalton assemblage of the Brand Site (3PO139) and included an experimental replication and resharpening of a Dalton point to evaluate and illustrate the process by which Dalton points from the assemblage came to exhibit varied conditions (Goodyear 1974:Figure 12). Often cited for such evaluations, Frison (1968) discussed the evolution of tool shape that resulted from retouch and resharpening. Frison's observation later became known as "the Frison effect" and refers to the change in tool shape as a result of modification and use, either for new functions or by continued use for singular functions (Jelinek 1976). This potential implies that the end result may not have been initially intended, or expected, as the tools use was adapted to specific needs throughout its use-life.

Another significant example of experimental evaluations can be found with Flenniken and Raymond's (1986) experimental reconditioning of Elko corner notched projectile points. In this study Flenniken and Raymond produced a sample of points which were then used as projectile points, and upon breaking from use were reconditioned into functional projectile points. This experiment focused on the apparent stylistic variability that is born out of the reconditioning of broken points back into functional tools.

Other evaluations of Early Archaic assemblages specifically have noted the apparent trajectory of tool resharpening and reconditioning within the toolkit (Austin and Mitchell 1999, 2009; Carter 2003). These evaluations have relied on observations from assemblages to infer the trajectory of resharpening. Upon evaluation of the Bolens at the Jeanie's Better Back site in Florida (8LF54), Austin and Mitchell (1999:Figure 38) present a hypothetical use-life sequence for a Bolen notched point, illustrating the various stages of reduction from the preform, to the finished point, to a reconditioned point, to the eventual exhausted point. This line of thinking led to a later evaluation of Bolen use-life trajectories from the same assemblage (Austin and Mitchell 2009). Their evaluation of the use-life model of biface utility was focused on technological risk within the Bolen technological system. Risk of production or resharpening/reconditioning failures, as well as future tool viability, were considered within the context of behavioral decisions of Bolen use or discard at the site. While their evaluation did not include an experimental approach towards understanding Bolen use-life trajectories, they did focus on the behavioral decisions around resharpening/reconditioning events that produced the residues present at the site.

Of particular importance to the present study, Towner and Warburton (1990) undertook an experiment to evaluate projectile point changes after reconditioning events, assess the resulting debitage, and infer assemblage predictability from such data. They conducted an experiment strikingly similar to that of Flenniken and Raymond's (1986) whereby they produced 30 Elko corner notched projectile points, used them as projectile points in order to produce breaks, then reconditioned them into again functional projectile points. In so doing they quantified the portions of the projectile points that required reconditioning, and through an intensive analysis of the debitage assessed the visibility of such production and reconditioning residues in the archaeological record. Their intensive debitage analysis quantified the debitage by flake type: platform preparation flake, pressure flake, notching flake, and alternate flake (a result of removing a squared edge). They also evaluated the debitage by size class (1, 1/2, 1/4, 1/8, and 1/16 of an inch) and found that 98% of production debitage, and 99% of reconditioning debitage to be less than 1/4 of an inch. In conclusion they propose that a minimum of 1/8 of an inch screening should be used to capture and evaluate the reconditioning flakes from Elko corner notched projectile points.

Nipper Creek Kirk Cache

Because the Kirk corner notched mode presents a wide range of observable variability both in terms of stylistic and functional archetypes, as well as the resulting variability of observable traits from functional use and reconditioning, it is necessary to reduce such variability on a logical basis for this experiment to produce meaningful results. This means a basis needed to be established for the sub-mode of Kirk that would be reproduced and resharpened such that stylistic variability was minimized and thus more consistent across the experimental specimens. Choosing an archetype, or sub-mode, of stylistic and functional design required some basis of consistency, contemporaneity, and recognition such that comparable examples might be easily identified within assemblages and would thus be comparable for analytical purposes in the future.

The Nipper Creek Kirk Cache from 38RD18 (Goodyear et al. 2004; Wetmore and Goodyear 1986) was chosen as the six hafted bifaces therein are indisputably a contemporary assemblage that are easily recognizable as Kirk corner notched hafted bifaces. The Nipper Creek Kirk cache has previously been utilized in comparative studies as a "short time" assemblage for assessing Kirk corner notched variability in South Carolina, and its use here will allow for some degree of comparability

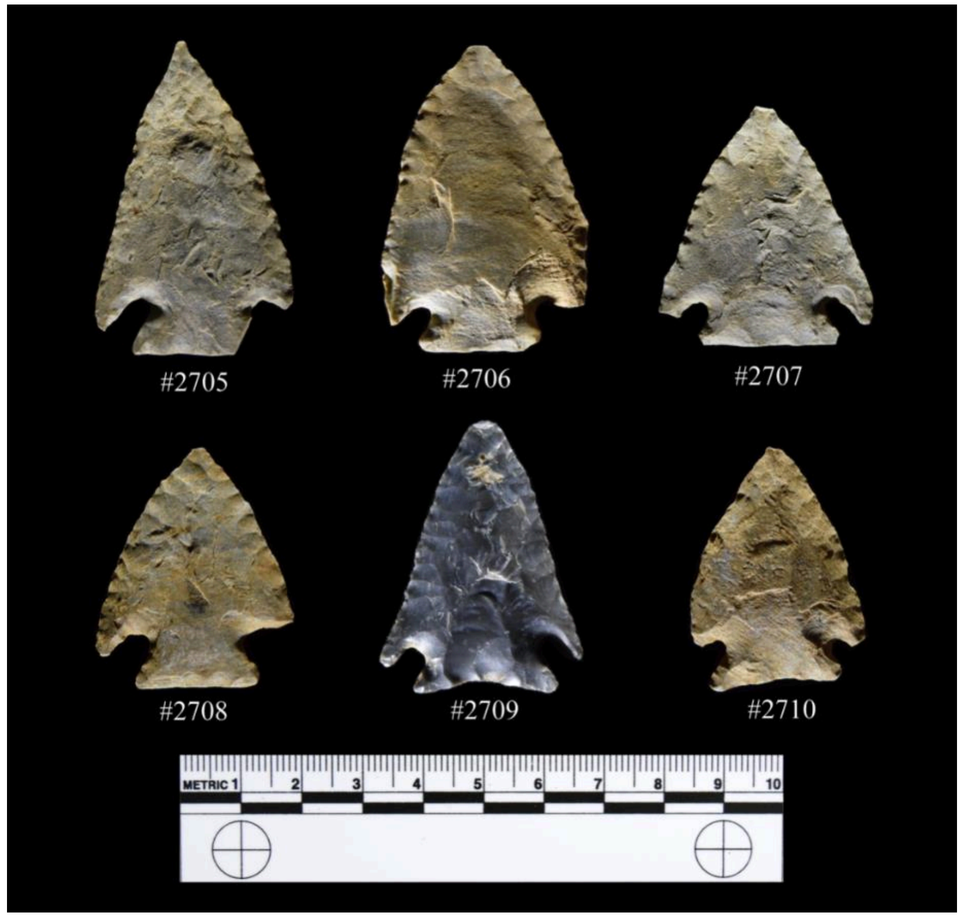


Figure 1: Nipper Creek Kirk Cache from 38RD18.

across such studies (White 2016b). This cache has previously been described by Goodyear et al. (2004) as having been found within a twelve by twenty-two centimeter area, with one biface sixty centimeters removed from the cluster. The overbearing sediments had been mechanically stripped in 1970 from the site, which later facilitated the discovery of the cache during the 1986 University of South Carolina archaeological field school on the site. Two hafted bifaces were exposed on the surface and troweling of the area revealed the additional examples. A total of ten contiguous square meters was then excavated around the cache to ensure no additional artifacts were present and associated with the cache. No pit feature was identified, though all of the hafted bifaces appeared to be resting on the same surface. Goodyear et al. (2004) also state that because mechanical stripping had occurred, it could not be guaranteed that all of the artifacts originally associated with the cache had been recovered, as well as explain the biface that was sixty centimeters removed from the cluster. Additional debitage and fire cracked rock were also recovered from the excavation efforts within the firm soil matrix surrounding the hafted bifaces.

Of the six hafted bifaces recovered, five examples were made of metavolcanic rhyolites (two identified as aphanitic or fine-grained, and three as flow-banded rhyolite) presumably from the Uhwarrie Mountain sources in North Carolina (Daniel 1996, 1998, 2001; Steponaitis et al. 2006), while one example was made of Knox Chert from the ridge and valley region of eastern Tennessee (Sweat 2009). The cache of hafted bifaces was reexamined by the author and were measured and photographed for the present study. Figure 1 illustrates the cache with the author's assigned study numbers, and Table 1 presents the resulting attribute data collected.

Table 1: Nipper Creek Kirk Cache Metric Data.

Study #	Material	Max. Length	Max. Width	Max. Thickness	Haft Length	Haft Thickness	Base Width	Blade Width	Neck Width	Weight (g)
2705	Aphanitic Rhyolite	51.73	32.62	6.48	9.24	5.4		32.62	16.21	10.06
2706	Flow Banded Rhyolite	50.21	33.84	7.28	8.19	4.97	19.67	33.84	16.74	13.21
2707	Aphanitic Rhyolite	39.53	35.28	6.85	7.15	5.26	22.91	35.28	19.05	8.49
2708	Flow Banded Rhyolite	39.56	32.84	6.72	9.57	4.84	20.49	32.84	15.38	7.44
2709	Knox Chert	44.94	33.55	8.04	8.44	6.04	23.75	33.55	18.05	9.87
2710	Flow Banded Rhyolite	39.11	28.76	7.03	8.62	5.1	22.01	28.76	17.16	7.77
AVG		44.18	32.82	7.07	8.54	5.27	21.77	32.82	17.1	9.47

The Nipper Creek Kirk cache represents a consistent sub-mode of manufacturing style. The hafted bifaces are produced from triangular shaped preforms with unambiguous corner notches, blade margins that are neither beveled nor serrated and are bifacially resharpened, and straight basal shapes that exhibit basal thinning. The notches appear to have been produced through the application of pressure notching, as opposed to indirect percussion which often produces large "C" shaped negative cones. The points are also similar in overall size and appearance.

One example from the cache, study specimen #2709, has a slightly concave basal shape that exhibits pronounced basal thinning
flakes that could be described as flutes. This difference in basal shape is the single most noticeable attribute difference among the assemblage in terms of their manufacture technique and their stylistic variability. Though a minor difference, it is worth noting it is present on the hafted biface of the most exotic material. Given this is a cache, it is plausible that the metavolcanics examples could have been produced by the same individual, while the exotic Knox chert specimen could have been manufactured by a different knapper and later acquired through unknown means and included in the cache, or contributed to the cache by a separate individual during a ritualistic event. While either scenario cannot be definitely demonstrated, this potential could explain the slight variation in basal shape, and thus represent variability between individual knappers. Given #2709's exotic origin, it also likely represents evidence of social aggregation and or exchange which has been argued to have frequently occurred in the Fall Line locality in the central part of South Carolina wherein the Nipper Creek site is located (Anderson and Hanson 1988; Anderson and Sassaman 1996; Charles and Moore 2018; Daniel 1996, 1998, 2001; Michie 1996; Sassaman 1996; Wilkinson 2017a). The behavior of caching this assemblage of hafted bifaces may represent a ritual activity, such as the burial of an individual with grave goods, though no recognizable features or bone were identified (Goodyear et al. 2004:42), or for some other unidentified social purpose. Regardless of the purpose behind burial of the cache, the hafted bifaces appear to confidently represent a contemporary and consistent sub-mode of Kirk corner notched design.

Experiment Methodology

After examining the Nipper Creek Kirk cache, it was considered how best to utilize the cache as the archetype for the Kirks to be produced and resharpened in this experiment. The metrics obtained from the Nipper Creek Kirk cache were averaged, and these average metrics were used to produce a rough sketch of a Kirk fitting those measurements. This sketch was observed and committed to memory. Consideration was given to keeping the sketch nearby during the experiment to serve as a visual template as to the desired form and size of the reproduced points. However, as the sketch was not intended to be used as an exact guide, nor was it intended that reproduced points should match the exact dimensions of the Nipper Creek Kirks, this was not done in order to allow for natural variability in resulting point sizes and shapes. The sketch was only intended to serve as a visual template much in the way a mental template may have existed in the minds of prehistoric knappers, or the preexisting examples they were intending to replace. As hafted bifaces were not made in molds whereby exact replication would be possible, variability is always present among prehistoric assemblages no matter if a group of hafted bifaces were all made by the same knapper, at the same time, with the same raw material, and with the same tools and techniques, etc., as several of the points in the Nipper Creek Kirk Cache may have been. This experiment was not structured to limit production variability, only to create finished bifaces that would be similar enough in size, shape, and manufacturing technique to be comparable with regard to their resharpening trajectories.

A total of twenty spalls, or flake blanks, of green Welded Vitric Tuff were selected from the authors knapping material stores so that all the Kirks created for the experiment would be of the same homogenous, high-quality raw material. This material originates in the vicinity of Asheboro, NC, and was commonly utilized for Kirk production and has been observed in South Carolina assemblages (Daniel 1996, 1998, 2001; Wilkinson 2014, 2017a). A total of twenty spalls were selected with hopes that a minimum of ten Kirks would survive the manufacture and resharpening process, as production failures were expected. These blanks were selected by sorting through the material stores in search of blanks that would be adequate in size, thickness, and shape to produce a Kirk of the approximate size and shape of the Nipper Creek cache Kirks. Once these blanks were selected, they were bagged, assigned a specimen number, then measured and photographed before the experiment began.

In order to ensure the consistent and complete collection of debitage throughout the experiment, a cheap solid white shower liner was purchased and laid down on a flat surface to capture the knapping debris and aid in efficiently gathering the debitage by funneling the debris into zip lock bags labeled by specimen number and the appropriate knapping stage. The resulting debitage from each stage of reduction and resharpening was later analyzed and is presented below.

The knapping tools used for this experiment were all-natural materials such as would have been used prehistorically. This was done in order to accurately replicate the resulting debitage and biface attributes that such materials would create. Natural quartzite hammerstones of various sizes were used for early stages of reduction, along with several antler billets of differing sizes. Abrading was done with a sandstone abrader, and pressure flaking was done with the same antler tine throughout the experiment. This antler tine pressure flaker was also reconditioned with the sandstone abrader after each cycle of resharpening in order to provide consistency in the contact between the antler and the biface, and the resulting character of the pressure flaking debris.

The stages of manufacture and resharpening that were implemented during this experiment were decided upon considering the likely episodes of reduction that might be present on prehistoric sites with regard to location and purpose of such sites on the landscapes near or removed from raw material sources. The reduction of a flake blank to a late stage preform was considered the first stage of reduction, as often preforms produced at or near quarries are found away from quarries that had not yet been turned into finished points. While often lithic studies evaluate or discuss different stages of bifacial reduction between the flake blank and the finished point, this stage concluded with a late-stage preform that was complete enough that almost all percussion flaking was finished, and pressure flaking and notching would be required to finish the point. Therefore, the preform that resulted from this stage of reduction was ready to be turned into the finished point and did not require the further removal of significant mass.

The second stage of reduction was to turn the late stage preform into the finished point, and as stated above was primarily executed by pressure flaking and notching. Only minimal percussion flaking was used at this stage when necessary. This stage was intended to represent the potential behavioral residues of curated preforms being turned into finished points away from quarry sources, in hopes that the resulting debris could be used to identify and evaluate such behaviors on sites removed from quarry localities.

The remaining stages were individual episodes of resharpening of each point. It quickly became clear throughout this experiment that a resharpening procedure and definition needed to be decided on in order to maintain consistency of purpose, strategy, and the resulting debris. As noted above, the Kirks in the Nipper Creek Kirk cache exhibit blades that are not beveled or serrated and were instead bifacially resharpened. After ruling out unifacial beveling, and serrations (either through unifacial or bifacial means) as resharpening strategies, it was also considered that there were multiple possible approaches to bifacial resharpening.

This experiment was not designed to determine the function of these hafted bifaces, but rather to consider that each hafted biface maintained the ability to function either as a projectile point or has a knife after each resharpening without the introduction of functional failures such as impact fractures or breaks to portions of the hafted bifaces. Therefore, it was important to prioritize that a sharp edge was maintained after each resharpening cycle, while also ensuring that the hafted biface maintained a sharp and functional tip. Both could easily be accomplished by removing either a series of pressure flakes from one face of each margin, or by removing a series of pressure flakes from both faces of each margin. By removing a single series of flakes from one face of each margin, and alternating which face is resharpened between cycles, a hafted biface could maintain a bifacially resharpened appearance while also doubling the number of cycles that the biface could sustain. This bias was avoided by resharpening both faces of each margin during each cycle, with emphasis towards maintaining a sharp edge and sharp, functional tip. When necessary to ensure both were maintained, the entire length of each margin was resharpened, but most often care was primarily given to the distal end with less intensive resharpening required for the lower section of the blade. This was done in order to maintain a functional tip as it was the most fragile portion of the finished biface. Before each new cycle of resharpening, the sandstone abrader was used to gently abrade the biface edges from tip to base along the blade. This was done to mimic use-wear attrition, and to dull and abrade the margin for the next series of pressure flakes. As the bifaces were resharpened, the blade ears became more and more fragile until the point where resharpening resulted in there unintentional but necessary removal. Because this experiment focused on resharpening rather than reconditioning, which excluded functional failures, delicate blade ears would be identifiable in the resulting debitage of these resharpening cycles, whereas they might not be as frequently present in archaeological lithic reduction assemblages due to being lost during use.

Biface Resharpening Results

The process of manufacturing Kirk corner notched hafted bifaces for this resharpening experiment resulting in a total of fourteen complete Kirks. A total of five production failures occurred during the initial stage of reducing flake blanks to preforms, while only one failure occurred during the second stage of turning the preform into a finished point. This sixth and last failure occurred during the attempt of percussion thinning the base, and the resulting end shock broke the preform in two. Figure 2 illustrates the fourteen finished Kirks before the resharpening cycles began.

All fourteen Kirks sustained a minimum of eight cycles of bifacial resharpening. Of the fourteen, specimen numbers #1, #9, #15, #18, and #19 reached exhaustion during the eighth cycle of resharpening. Specimens #14 and #17 reached exhaustion during the ninth cycle, specimens #2, #5, #6, #10, and #11 reached exhaustion during the

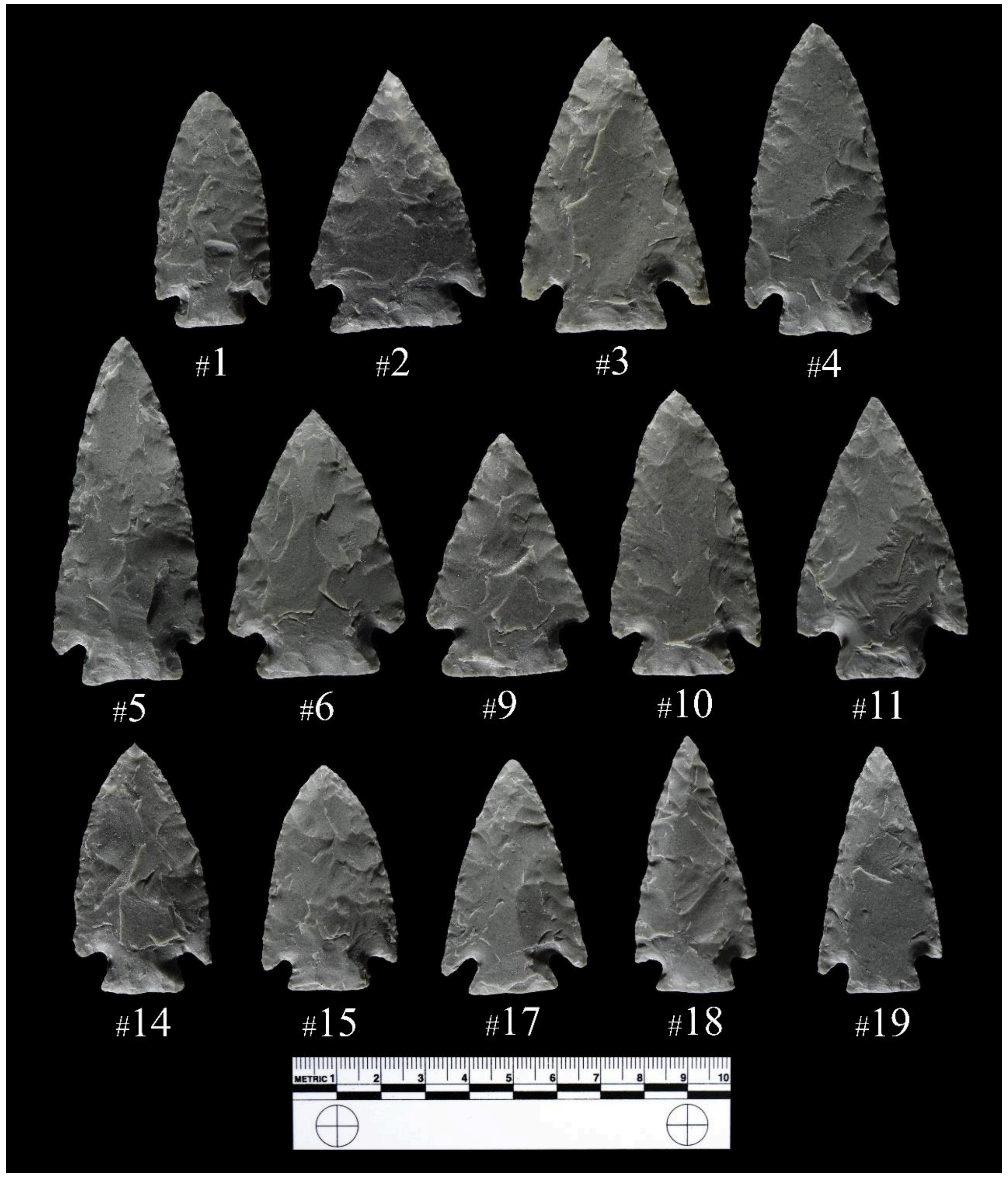


Figure 2: Kirk corner notched hafted bifaces produced for this experiment.

tenth cycle, and the final two specimens, #3 and #4, reached exhaustion during the eleventh cycle of resharpening. A total sum of resharpening events equaled 130, which was divided by the total number of fourteen specimens for an average of 9.3 cycles of resharpening. This represents the average number of resharpening episodes that a Kirk corner notched hafted biface can sustain under the parameters of this experiment.

Throughout the experiment, the bifaces were measured, analyzed, and photographed after each stage of reduction and resharpening in order to evaluate the changes in biface shape and attributes such that meaningful understandings of such changes could be reached. As discussed previously above, many attempts have been made to understand the trajectories of bifacial resharpening and use by examining residues from prehistoric

assemblages. Evaluating changes through experimentation aid in confirming the validity of observations and assumptions with regard to which attributes undergo the most change, or alternatively little or no change, from resharpening (and also reconditioning) events.

Figures 3 through 14 represent the evaluation of numerous metric attributes collected from the bifaces throughout the resharpening stages of the experiment but exclude the first two stages of reduction (blank to preform and preform to point). These scatter plots illustrate which changes the bifaces sustained from resharpening, and which attributes remained unchanged.

An evaluation of maximum length (Figure 3) illustrates a consistent decline in overall length throughout the resharpening process. Maximum blade width (Figure 4) shows a less consistent trend, with the most dramatic decreases in width occurring in the initial stages of resharpening and as exhaustion is reached. Maximum thickness exhibits a similar trend, with a very gradual decrease in thickness (Figure 5). Some inconsistencies in how, or rather where, on the biface the measurements were taken lead to some points appearing to gain thickness after some stages of resharpening. This of course did not happen and represents investigator error during analysis. However, despite this error an overall trend it apparent that blade thickness only gradually decreases but is overall relatively stable. An additional measurement of blade width positioned halfway between the top of the haft and the tip was also taken to evaluate blade change. Figure 6 illustrates a more dramatic decrease in blade width due to resharpening, and likely indicates the emphasis placed on maintaining a functional sharp tip. This measurement also illustrates some investigator error due to the subjectivity of where this measurement was taken.

Additional evaluations of the bifaces illustrate other stark changes as a result of the resharpening pressures. Blade length, as illustrated in Figure 7, was calculated by subtracting haft length from maximum length, and illustrates a consistent decline in size that parallels the pattern presented for maximum length. Also parallel to these patterns, is the consistent decline in weight as a result of the loss of mass from resharpening pressures (Figure 8).

Briefly discussed above, Daniel (2002: Figure 3-4) evaluated Kirks from the G.S. Lewis East site and illustrated the Kirk tip angle metric. Personal communication with Daniel (2019) indicated that his measurement of tip angle was obtained through the use of a homemade goniometer. This goniometer was created by riveting two protractors together. While this method is no more or less accurate than the use of calipers, as individual investigators will always have some degree of error or inconsistency in obtained metrics due to subjectivity in measurement methods, caliper sensitivity, etc., an alternative method was decided on for the present study. The author did not have access to a goniometer, nor did he wish to create one, as implementing geometric calculations from already obtained metrics would provide a tip angle metric with less subjectivity or error.

Tip angle was calculated by utilizing an online calculator to calculate the angles of an isosceles triangle when the height and basal width are known. Blade length represents height in this calculation, and maximum blade width represents the basal width. By utilizing the calculator at "https://keisan.casio.com/exec/system/127385020 2", the base angle was obtained for each biface per resharpening episode. Because the sum of the angles of a triangle equal 180 degrees, a simple formula was written in the excel spreadsheet which stored the data such that this base angle was multiplied by two, then subtracted from 180 to produce the resulting tip angle value for each biface per resharpening episode. As Figure 9 illustrates, tip angle increases with resharpening cycles consistently. Though only a slight increase is present throughout the first few cycles, there is a consistent increase thereafter with some dramatic increases as points reach exhaustion.

A bivariate evaluation of blade length and tip angle (Figure 10) illustrates a pattern consistent with what Daniel (2002: Figure 3-4) presents upon evaluating the G.S. Lewis East assemblage. As

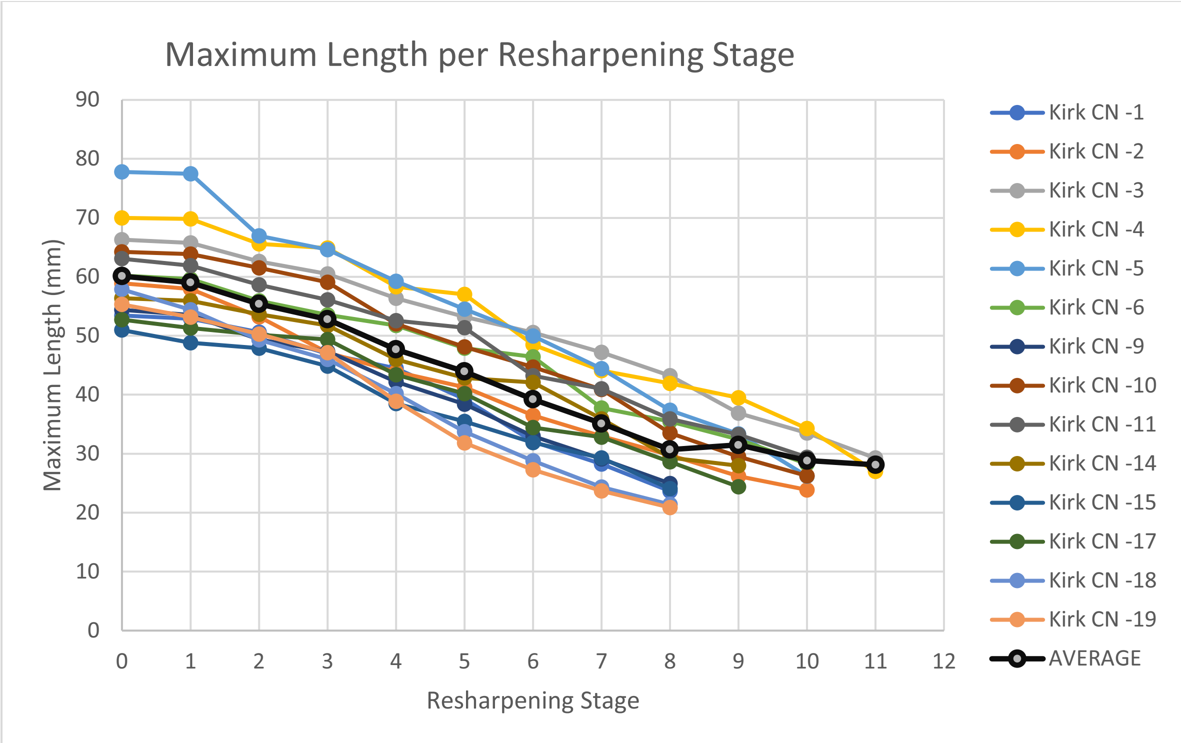


Figure 3: Maximum Length of all Kirks per Resharpening Stage.

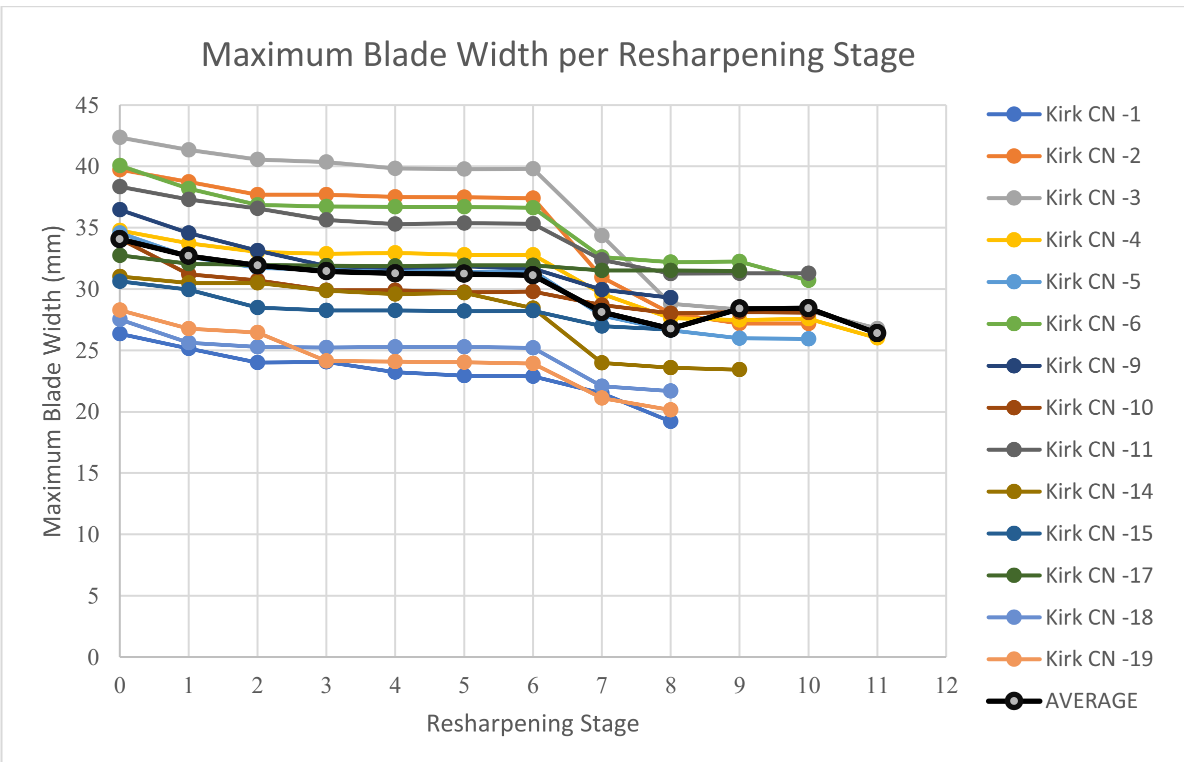


Figure 4: Maximum Blade Width of all Kirks per Resharpening Stage.

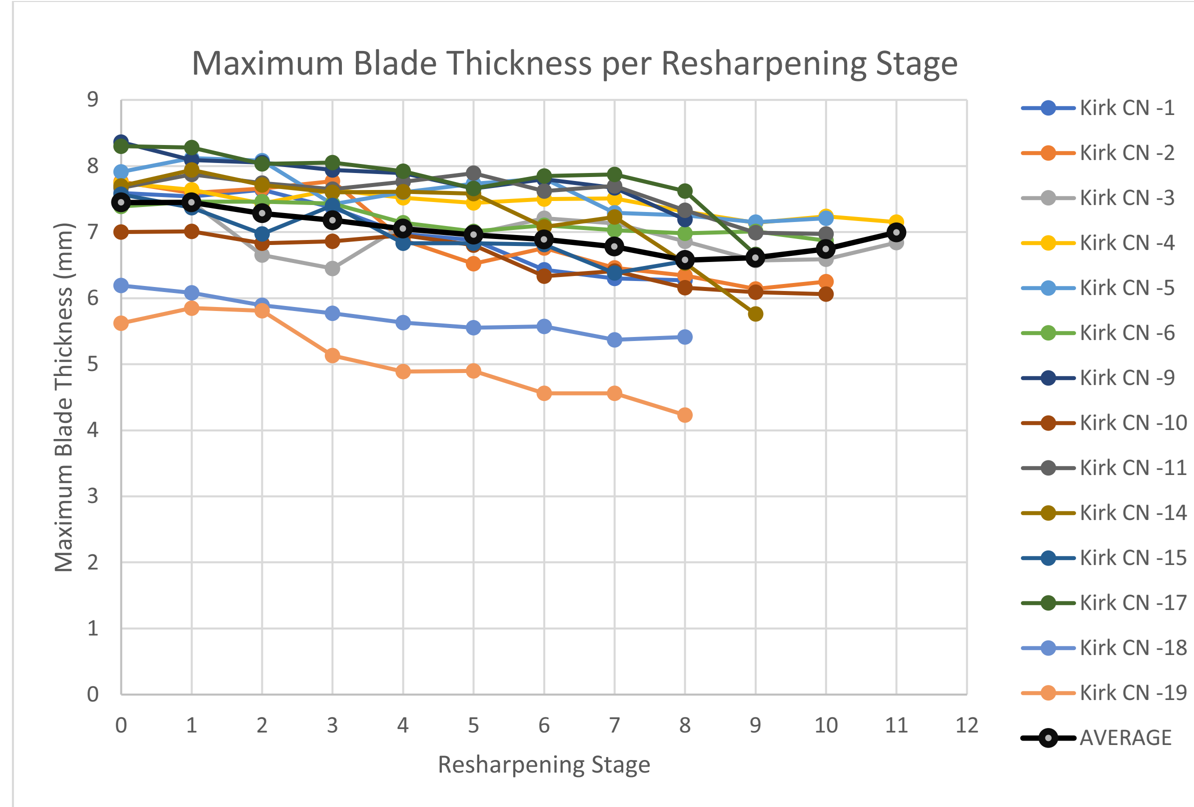


Figure 5: Maximum Blade Thickness of all Kirks per Resharpening Stage.

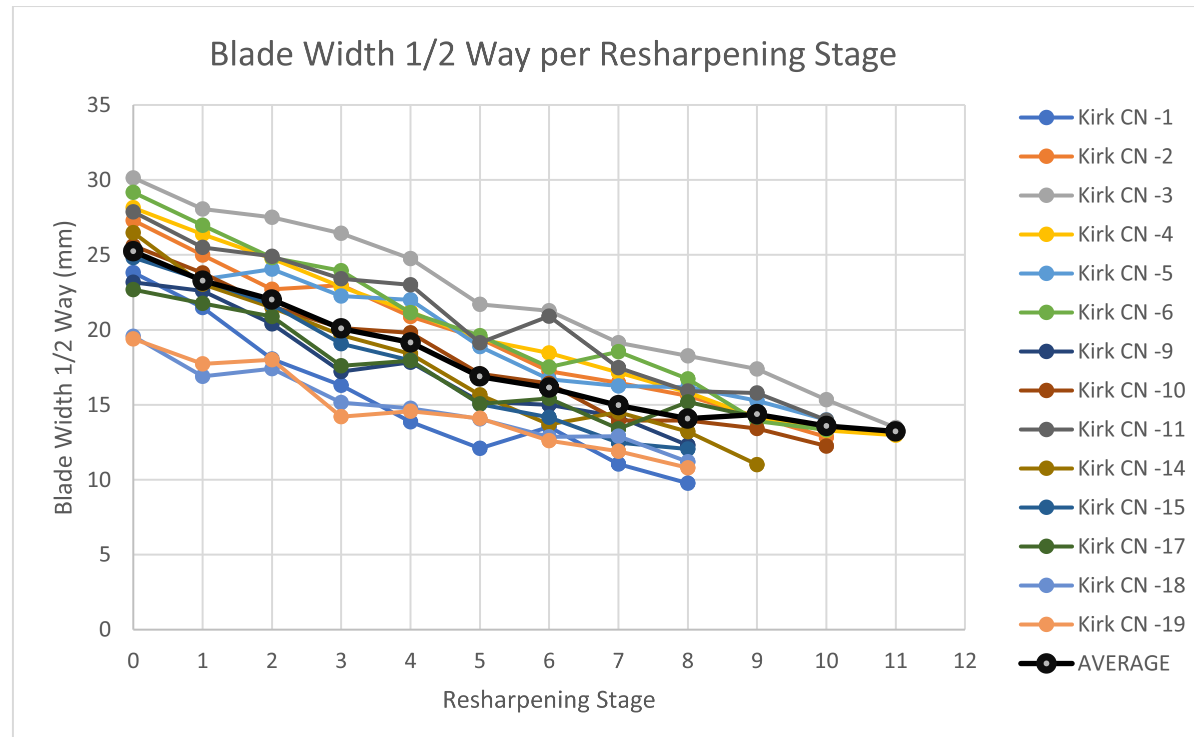


Figure 6: Blade Width half-way between top of haft and tip of all Kirks per Resharpening Stage.

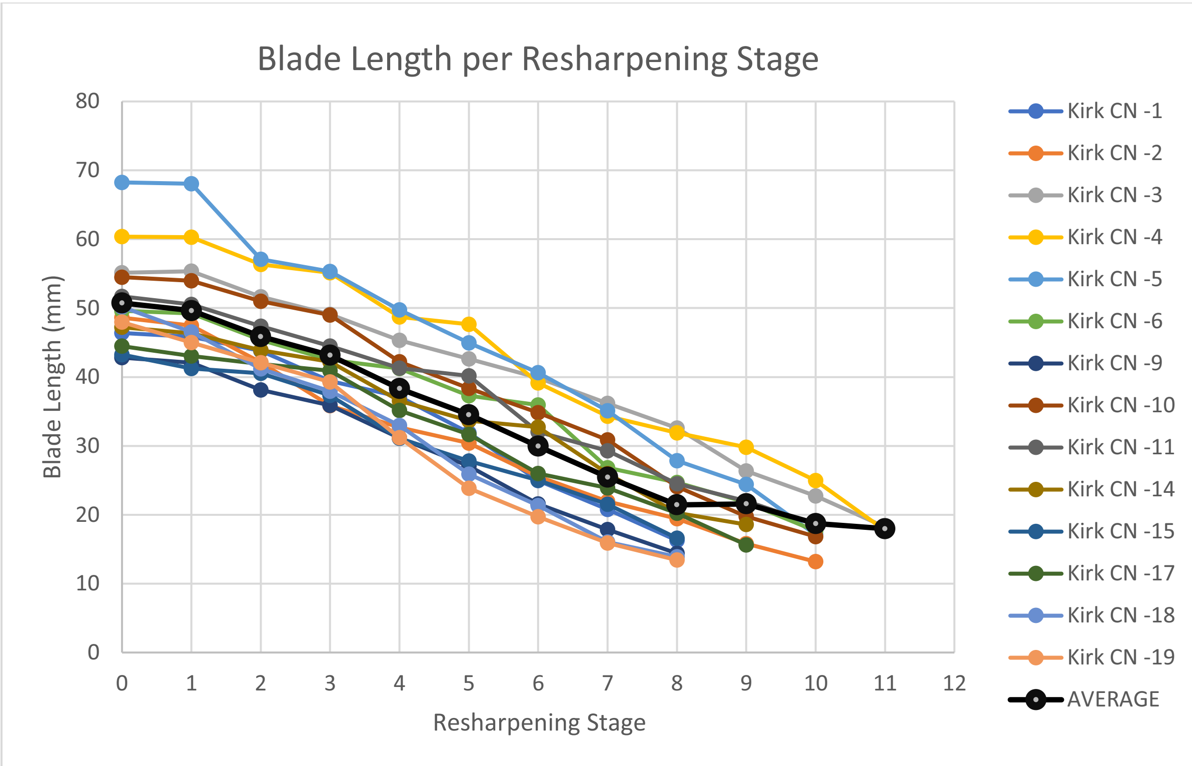


Figure 7: Blade Length of all Kirks per Resharpening Stage.

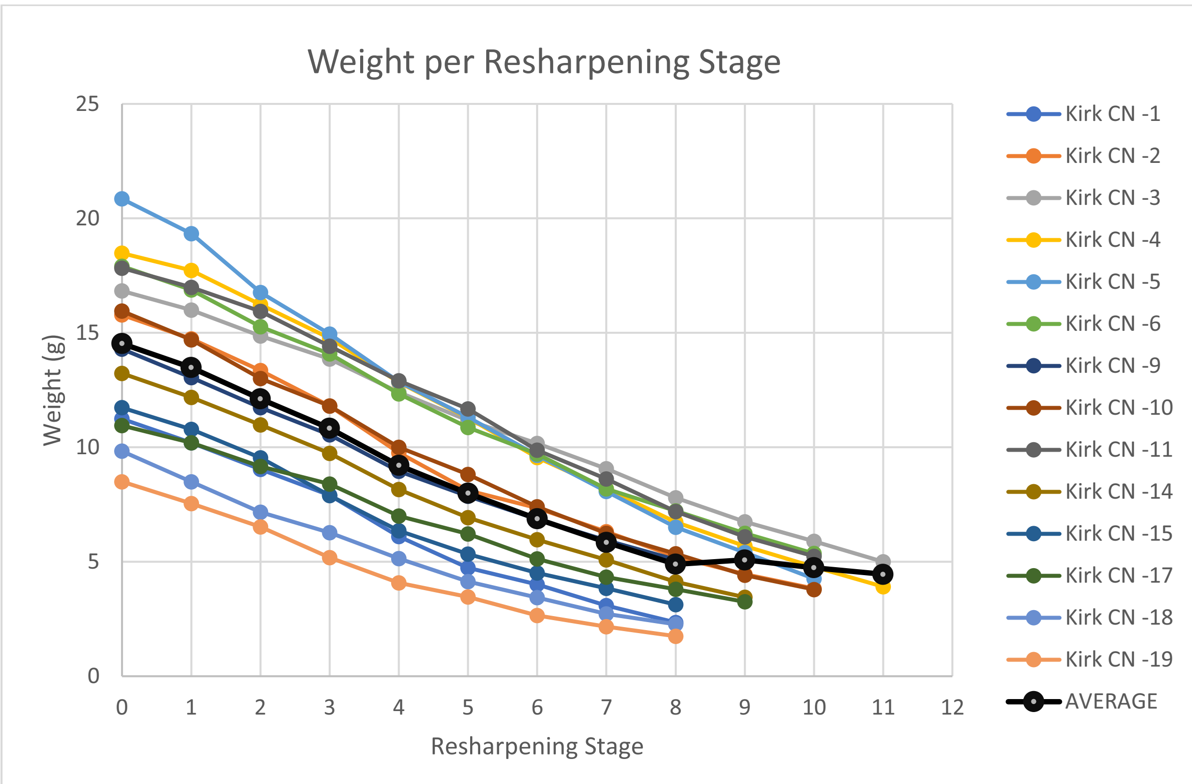


Figure 8: Weight of all Kirks per Resharpening Stage.

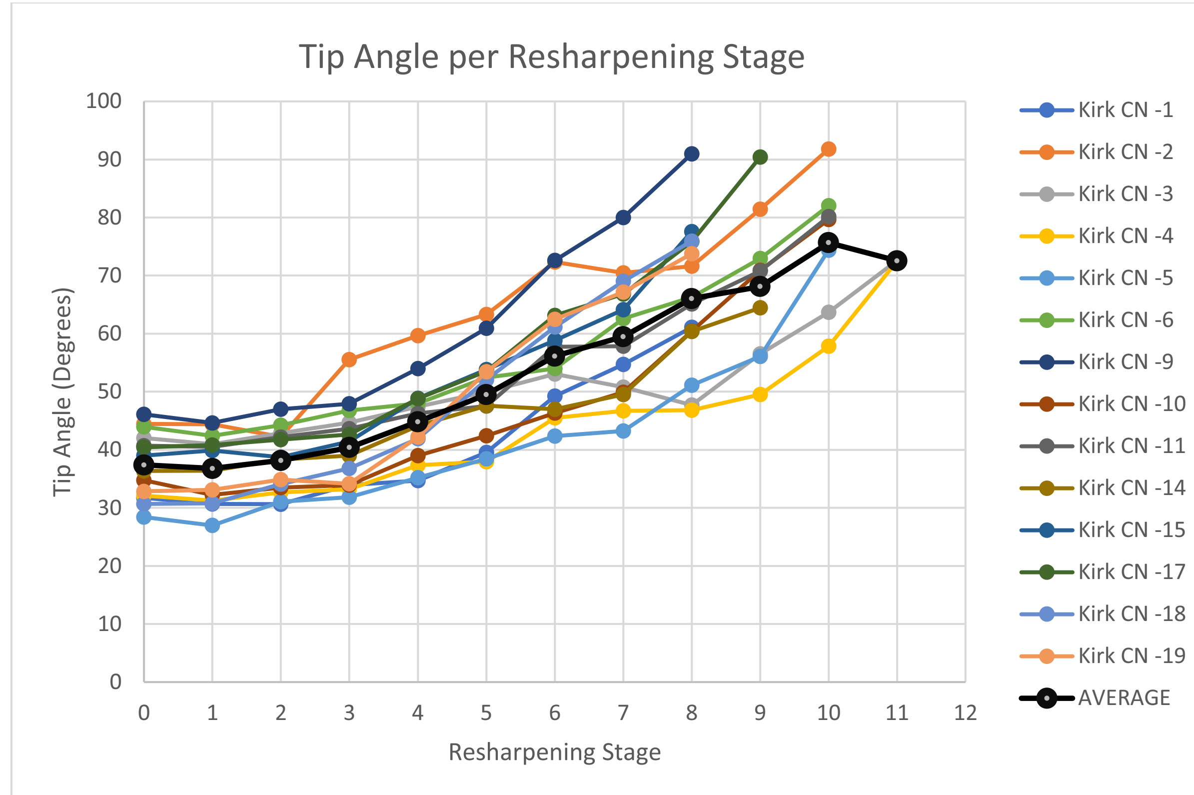


Figure 9: Tip Angle of all Kirks per Resharpening Stage.

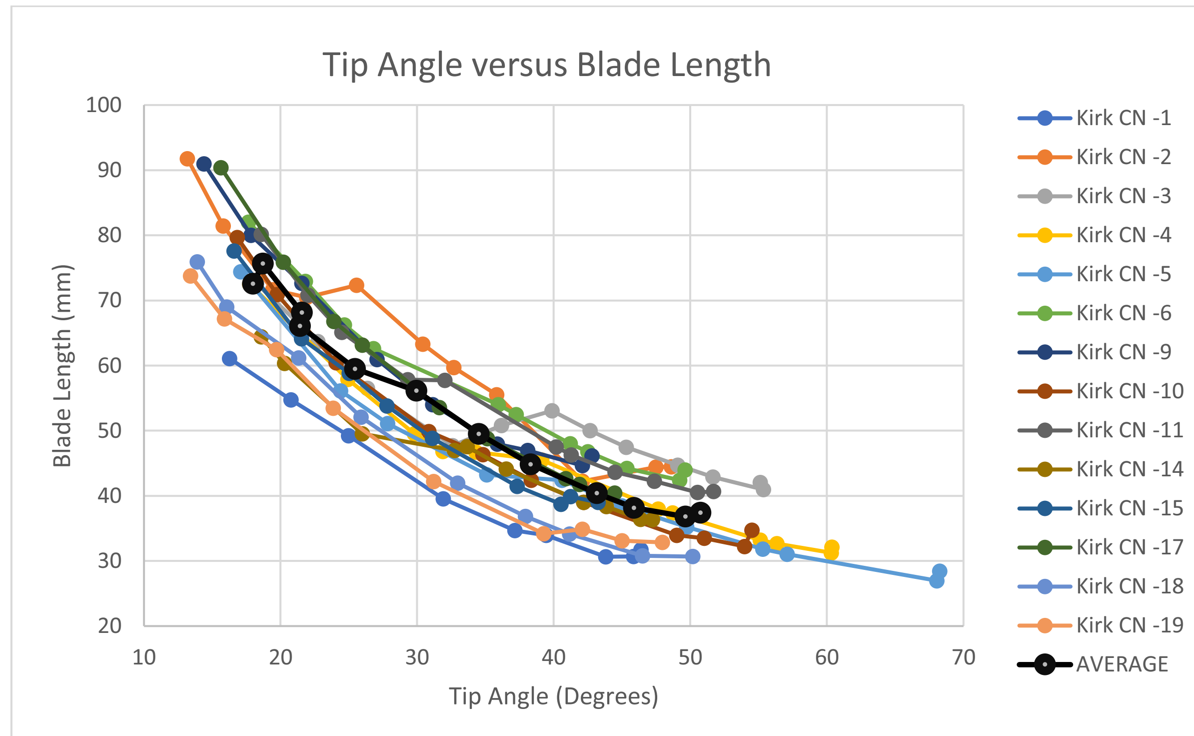


Figure 10: Bivariate plot of Blade Length vs. Tip Angle of all Kirks through all Resharpening Stages.

blade length decreases, tip angle increases. These metric changes are obviously correlated and illustrate the trajectory of change that a Kirk corner notched hafted biface undergoes as a result of resharpening pressures. This consistency between the experimentally derived data with that presented by Daniel, also demonstrates some validity in previous interpretations of blade resharpening strategies for Kirk corner notched hafted bifaces.

Haft metrics illustrate a strikingly different trend than the evaluations already discussed. As you can see in Figures 11-14, basal width, neck width, haft thickness, and haft length all remained extremely stable throughout the resharpening process. Some variation present throughout the evaluations of these attributes again illustrate some investigator error, though the overall patterns clearly indicate stability and the lack of change across these attributes. Given this experiment was focused on blade resharpening, and as reconditioning due to biface failures were not a part of the experiments process, this result was expected. This stability in haft dimensions indicates that the common assumption that haft attributes are unchanged during normal resharpening pressures is substantiated, and any haft changes that might occur on such bifaces are the results of reconditioning, as opposed to resharpening.

Lastly, Figure 15 illustrates an example of the visual changes that the hafted bifaces underwent and demonstrates the reality of the metric evaluations. Kirk corner notched hafted bifaces, when bifacially resharpened lose their length faster than they lose their width. With emphasis placed on maintaining a functional tip, rather than a long sharp blade edge (as beveled points do) an argument could be made for the importance of Kirks as projectile points rather than knives. While this experiment did not seek to demonstrate function, it is interesting to note the nature of changes that Kirk corner notched hafted bifaces endure as a product of the resharpening method utilized. This method, and the resulting changes, suggest that projectile point utility would be maintained throughout the trajectory of resharpening.

Debitage Results

In order to evaluate the visibility of both production and resharpening debitage residues in archaeological assemblages, and assess the nature of those residues, the debitage produced from the production and resharpening of the Kirk corner notched hafted bifaces were analyzed with a focus on debitage size, quantity, and mass. Attributes such as cortex presence, platform type, flake completeness, etc., were not evaluated. When unique characteristics of the resulting debris were present, such as the presence of a blade ear broken during resharpening, a note was made. The focus of this analysis was to evaluate the aggregate characteristics of a reduction episode with respect to an individual hafted biface, such that if a hafted biface reduction or resharpening event could be identified in isolation on an archaeological site those residues could be evaluated to interpret the reduction stage.

Because the focus of the debitage analysis was to evaluate the visibility of production or resharpening residues in archaeological assemblages, the primary attributes collected from each reduction event were size, count, and weight. These attributes were evaluated in order to assess the approximate loss of mass from each reduction event, and the size of the resulting debitage from each reduction event. In order to compare the analysis of debitage size to standard archaeological screening practices, sieves of 1 inch, 1/2 of an inch, 1/4 of an inch, 1/8 of an inch, and 1/16 of an inch, were used to size sort the debitage from the experiment. These sizes were chosen due to their commonality in debitage analysis studies as well as their even divisibility, and for comparability to the Towner and Warburton (1990) study. Debitage less than 1/16 of an inch was considered micro-debitage and saved but was not analyzed. Debitage of less than 1/16 of an inch would in most circumstances be wholly inconvenient and tedious to attempt recovery, and where present on sites would accompany larger debitage for identification and study.

All debitage was size sorted and attributes such as overall count and weight (to the nearest 1/100 of

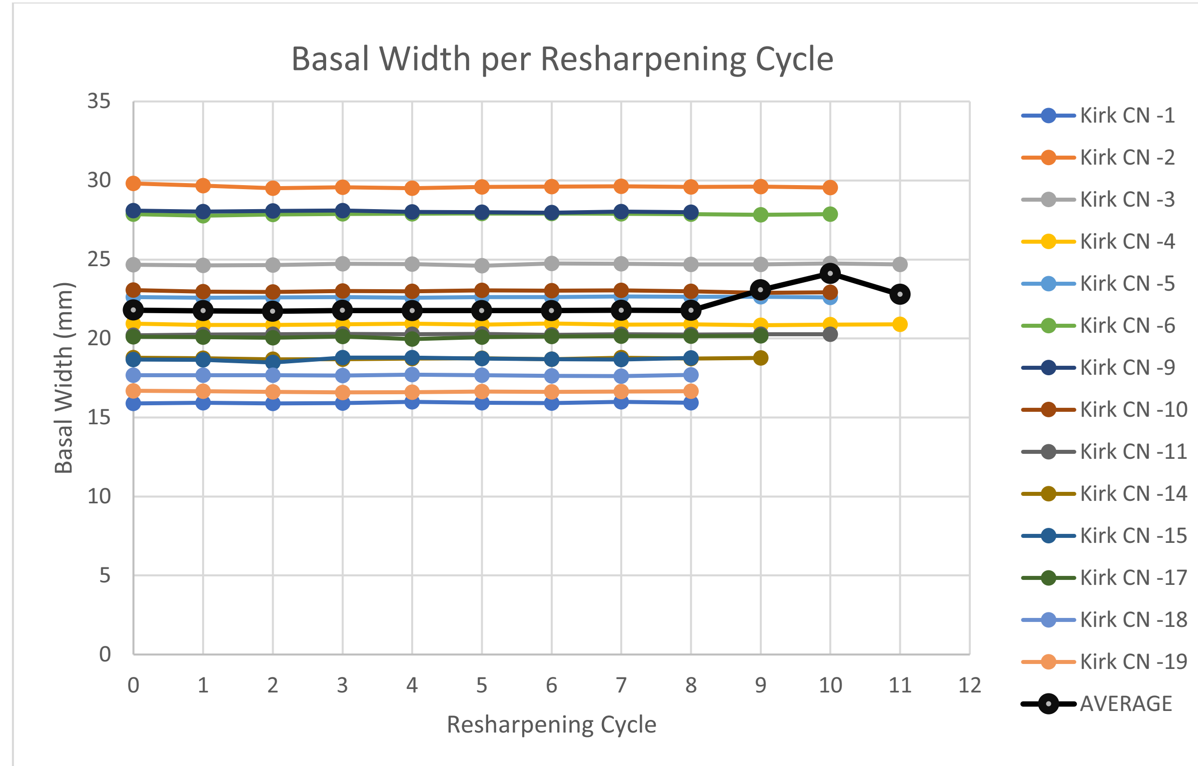


Figure 11: Basal Width of all Kirks per Resharpening Stage.

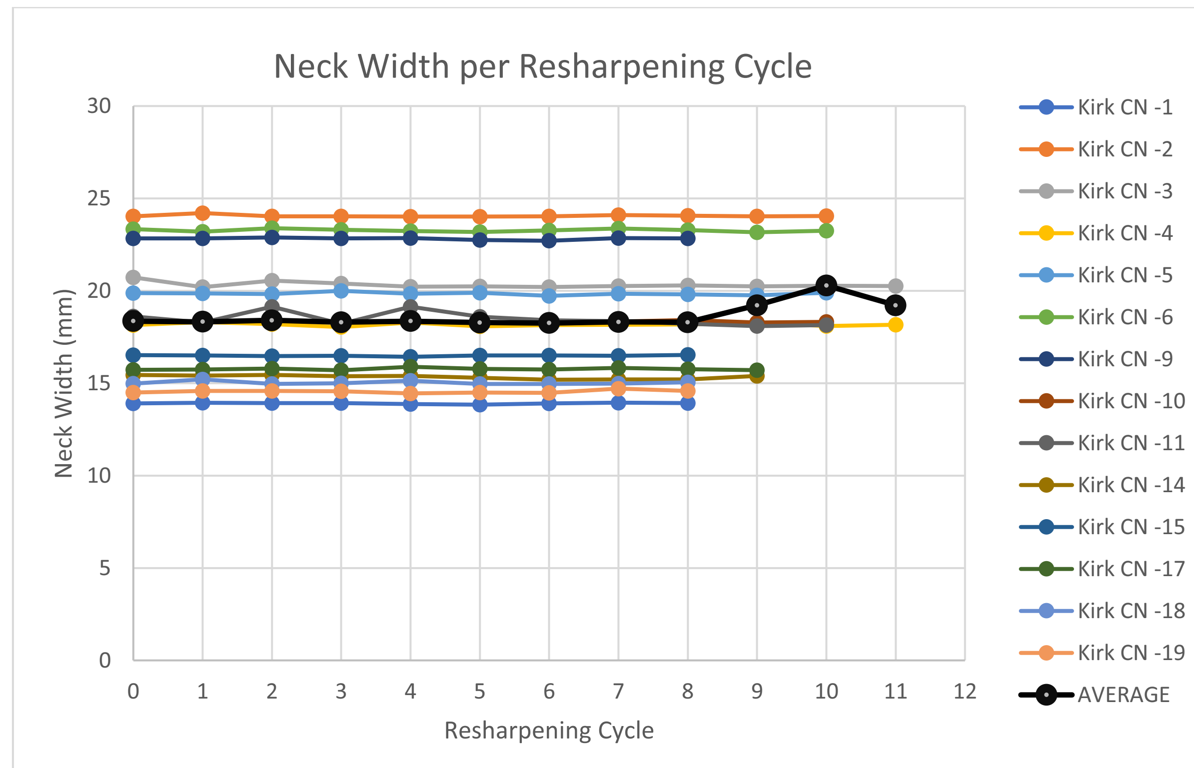


Figure 12: Neck Width of all Kirks per Resharpening Stage.

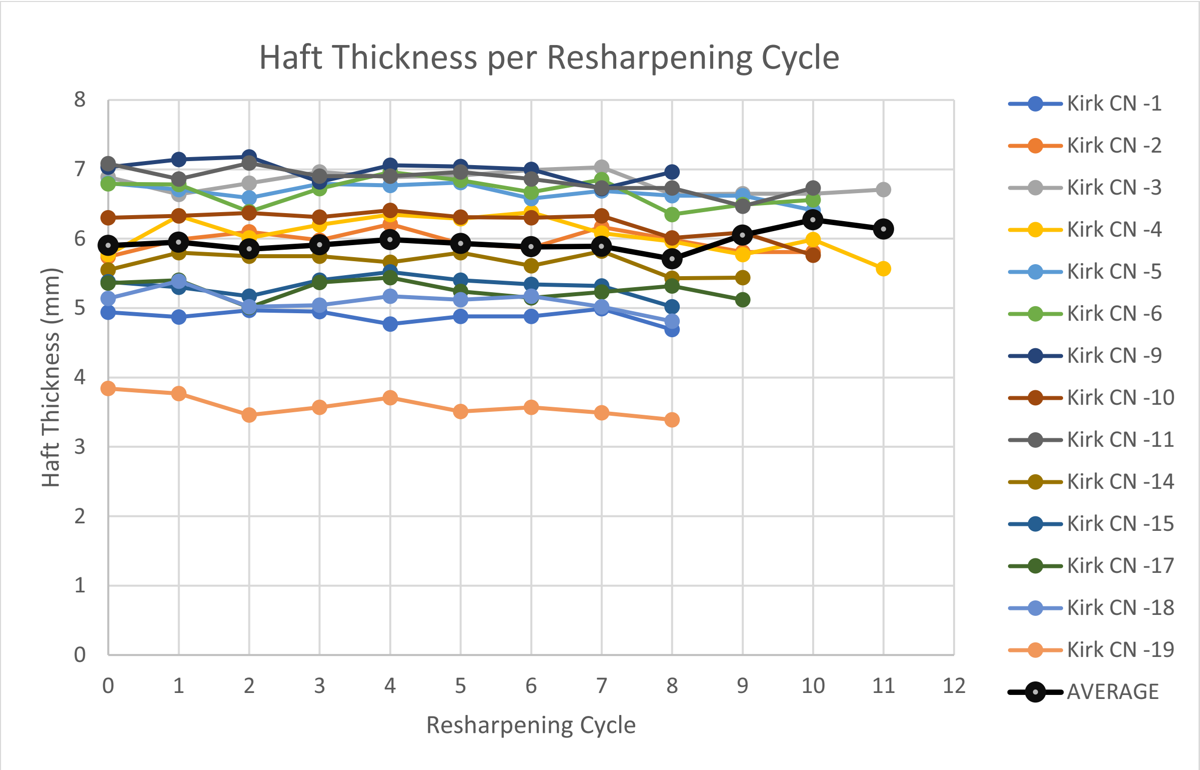


Figure 13: Haft Thickness of all Kirks per Resharpening Stage.

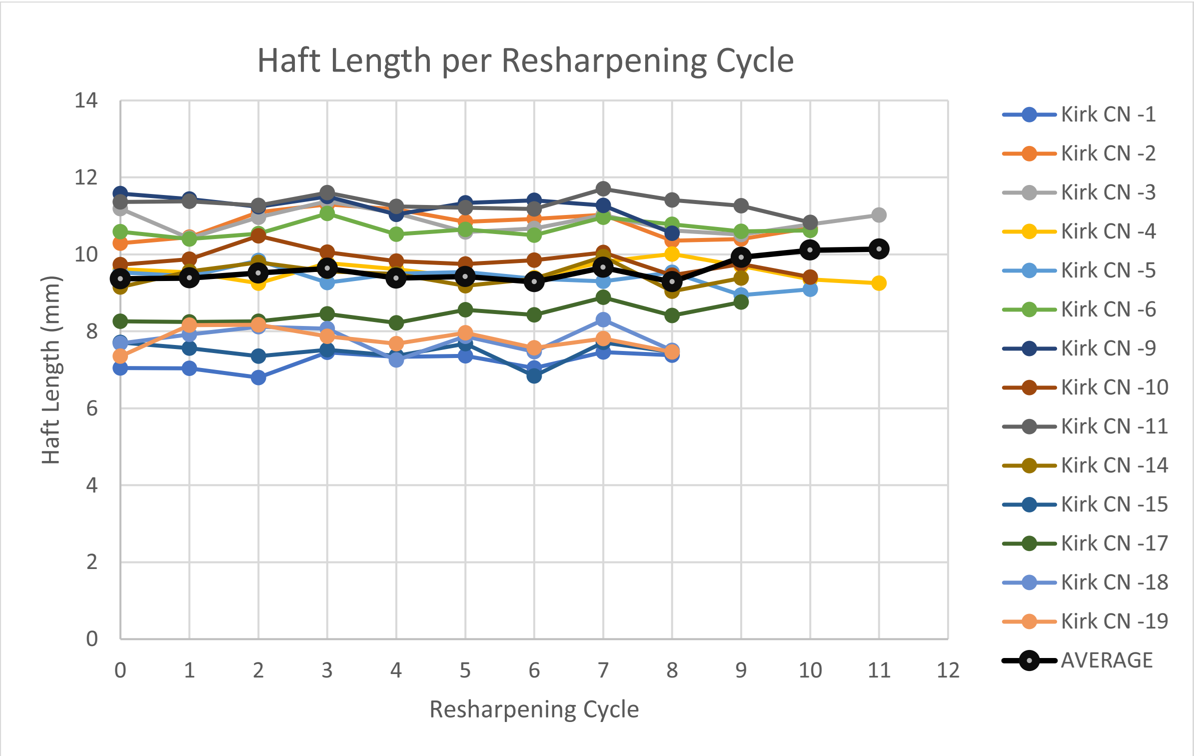


Figure 14: Haft Length of all Kirks per Resharpening Stage.

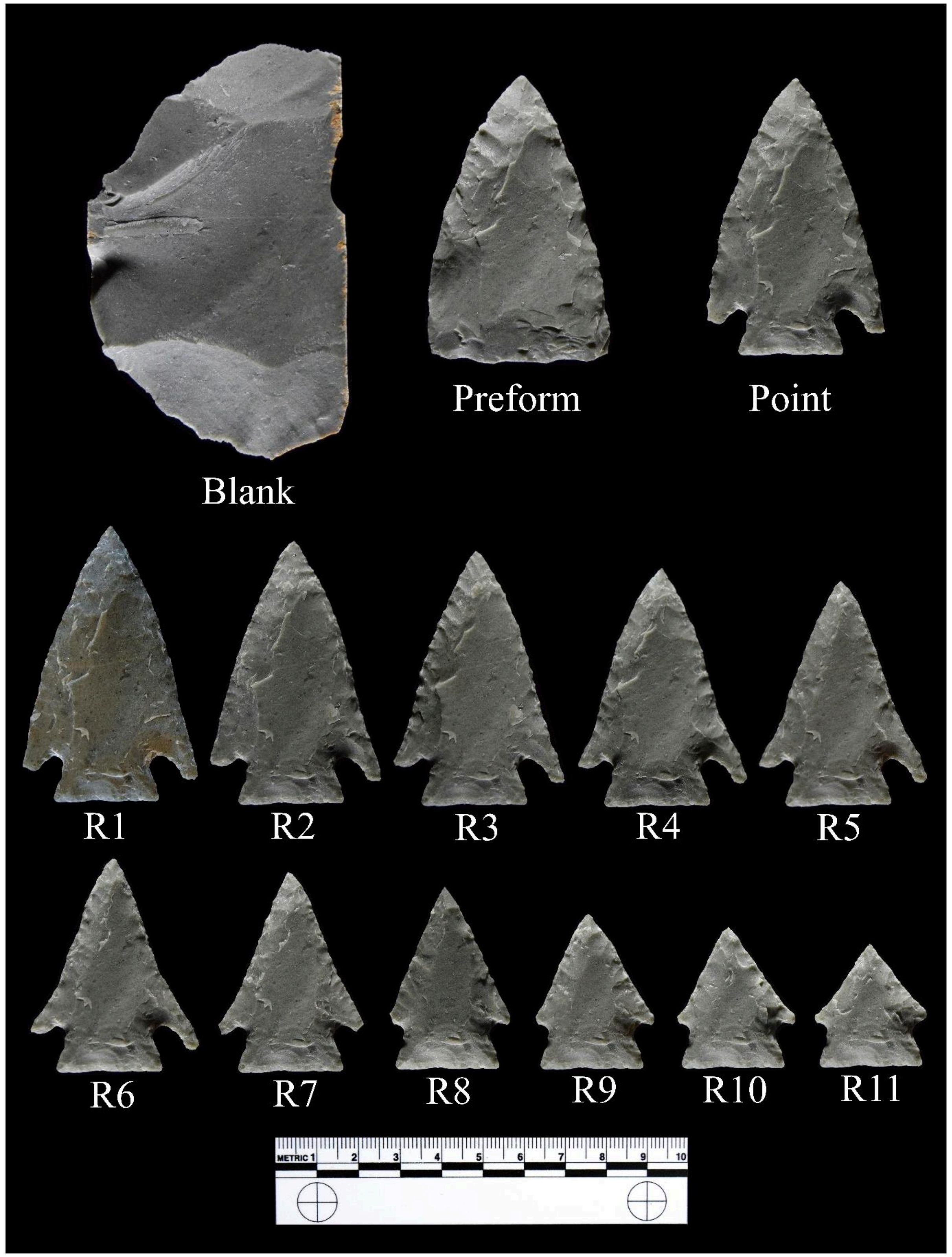


Figure 15: Kirk Specimen #3 Production and Resharpening Trajectory.

a gram) for each group of debitage were obtained. One exception to this was with debitage of 1/16 of an inch for the stages of preform and point production. The debitage in this size category was too abundant to justify the time required to count them. Instead, for these two stages, the debitage totals for the 1/16 of an inch size class were calculated based on average mass. By totaling the count and weight for this size class across all resharpening stages, a total of 6,706 flakes were counted for this size class with a total mass of 39.13g, then total weight was divided by total count (39.13g / 6,706) to approximate an average weight per 1/16 of an inch fragment of debitage of .005835g. The total weight for debitage of this size class for the first two stages of preform and point production were then divided by this average weight in order to closely approximate the total number of flakes in those categories.

Table 2 enumerates the total debitage counts and weights by size class and reduction stage across all experimental specimens. These totals encompass the entirety of debitage evaluated. Table 3 enumerates the average counts and weights for the debitage per stage and equalizes the relative values across stages. As points reached exhaustion, there is a noticeable step-like decrease in debitage totals in resharpening stages 8-11 (Table 2), but in Table 3 this pattern is not evident as a more gradual decline in debitage totals overall are seen due to the equalizing effect of averaging totals. As seen earlier in Figure 8, the decrease in mass was remarkably consistent across the bifaces that were resharpened. This consistent decrease in mass can also be seen in these tables, though the micro-debitage is not included in these values.

A very important attribute of this debitage analysis lies with the relationship between count and weight per size class. Particularly the relative percentage of debitage captured in size classes less than 1/4 of an inch, which is commonly a standard archaeological sampling size. Debitage counts and weights from all stages were totaled per size class across all stages and converted to relative percentages. Once this was done an interested pattern emerged. In Figure 16 you can see that the percentages of total counts for the larger size classes are very small with a dramatic increase in the percentage of total debitage count less than a 1/4 of an inch. Total percentage of weight illustrates a different pattern, whereby weight increases gradually up to the 1/8 of an inch size class, before dropping off significantly despite the increase in count. This intersection between count and weight percentages at the 1/8 of an inch size class is interesting and represents a noteworthy threshold for the evaluation of such residues.

By breaking down the debitage by size class and separating out the resharpening stages data from the preform and point stages, some interesting differences emerge. Table 4 illustrates the debitage totals and relative percentages per size class from all reduction stages and all resharpening stages. An overwhelming 97.23% of debitage counts from all stages and 99.97% of debitage counts from all resharpening stages are less than 1/4 of an inch in size. An evaluation of weight (or mass) exhibits a different pattern. Total weight is nearly equal for debitage from all stages that are larger and smaller than 1/4 of an inch (50.96% and 49.04% respectively), while total weight of debitage from all resharpening stages is starkly different. An overwhelming 99.86% of debitage mass from resharpening stages are less than 1/4 of an inch in size. By further calculating the total debitage counts and weights from all resharpening stages greater and less than 1/8 of an inch, this pattern shifts such that 70.65% of debitage total counts and 37.1% of debitage weight are less than 1/8 of an inch in size.

Throughout the analysis of the debitage, care was taken to identify and make note of any tip or blade ear fragments that broke off the hafted bifaces during bifacial resharpening. These fragments were included in the debitage count and weight data as if they were flakes, but a note was made as to which size class they were observed in. A total of twelve tip or blade ear fragments were identified in both the 1/8 of an inch size class and the 1/16 of an inch size class, for a total of twenty-four tip or blade ear fragments. There were a total of 130 resharpening episodes across the fourteen Kirks in this experiment, which means that approximately one

Table 2: Total Debitage from all Specimens by Size per Reduction Stage.

Stage	1” Count	1” Weight	½” Count	½” Weight	¼” Count	¼” Weight	1/8” Count	1/8” Weight	1/16” Count	1/16” Weight	Total Count	Total Weight
Blank to Preform	8	66.82	111	160.27	685	175.68	5839	185.07	~10769	62.83	~17412	650.67
Preform to Point			3	1.86	39	8.39	1019	28.39	~2732	15.93	~3793	54.57
Resharpening #1							269	5.01	832	4.46	1101	9.47
Resharpening #2							366	8.02	918	5.16	1284	13.18
Resharpening #3							351	8.32	745	4.39	1096	12.71
Resharpening #4					2	0.12	415	10.58	940	5.49	1357	16.19
Resharpening #5					1	0.03	305	7.69	756	4.25	1062	11.97
Resharpening #6							297	7.07	701	4.09	998	11.16
Resharpening #7							251	6.09	627	3.96	878	10.05
Resharpening #8							224	5.9	567	3.44	791	9.34
Resharpening #9							163	4.12	317	1.94	480	6.06
Resharpening #10							114	2.66	234	1.48	348	4.14
Resharpening #11							28	0.74	69	0.47	97	1.21
TOTALS	8	66.82	114	162.13	727	184.22	9641	279.66	20207	117.89	30697	810.72

Table 3: Average Debitage from all Specimens by Size per Reduction Stage.

Stage	1” Avg Count	1” Avg Weight	1/2” Avg Count	1/2” Avg Weight	1/4” Avg Count	1/4” Avg Weight	1/8” Avg Count	1/8” Avg Weight	1/16” Avg Count	1/16” Avg Weight	Total Avg Count	Total Avg Weight
Blank to Preform	1.3	11.14	7.9	11.45	45.7	11.71	389.3	12.34	~717.9	4.19	~1160.8	43.38
Preform to Point			3	1.86	4.9	1.05	72.8	2.03	~195.1	1.14	~270.9	3.9
Resharpening #1							19.2	0.36	59.4	0.32	78.6	0.68
Resharpening #2							26.1	0.57	65.6	0.37	91.7	0.94
Resharpening #3							25.1	0.59	53.2	0.31	78.3	0.91
Resharpening #4					1	0.06	29.6	0.76	67.1	0.39	96.9	1.16
Resharpening #5					1	0.03	21.8	0.55	54	0.3	75.9	0.86
Resharpening #6							21.2	0.51	50.1	0.29	71.3	0.8
Resharpening #7							17.9	0.44	44.8	0.28	62.7	0.72
Resharpening #8							16	0.42	40.5	0.25	56.5	0.67
Resharpening #9							18.1	0.46	35.2	0.22	53.3	0.67
Resharpening #10							16.3	0.38	33.4	0.21	49.7	0.59
Resharpening #11							14	0.37	34.5	0.24	48.5	0.6
TOTALS	1.3	11.14	10.9	13.31	52.6	12.85	687.4	19.78	1450.8	8.51	2195.1	55.88

out of every five resharpening events caused a tip or blade ear fragment to break off the bifaces. The patterning of such residues by stage appeared to be somewhat even throughout the stages of resharpening, though the first few stages did not exhibit as many fragments as middle and late stages of resharpening.

Discussion

Especially relevant in Early Archaic research is an evaluation of mobility and subsistence strategies as it relates to social organization across the landscape. Much has been inferred from large scale patterns about social interaction and exchange, and regarding subsistence in varied environmental locales. Understanding lithic technological systems are the foundation for such evaluations, as stone tools are almost entirely all that remains and has survived decomposition. As lithic technological systems are so crucial for our evaluations of Early Archaic lifeways, understanding the parameters of a specific technological systems functionality is crucial in allowing us to further enhance our interpretations of archaeological assemblages.

The Kirks produced and resharpening for this study demonstrate quantitatively many of the assumptions and assertions of previous studies. It substantiates the stability of the haft when use-wear does not produce breaks and reconditioning is necessary, while also illustrating the kinds of changes the functional blade portion of these tools experience. While this study did not incorporate functional failures as previous studies have (Flenniken and Raymond 1986; Towner and Warburton 1990), it sets a foundational understanding for the trajectory a Kirk corner notched hafted biface will undergo if not inhibited or affected by use-wear failures. This evaluation sets the stage for further evaluations of utility which can enhance our understanding of Kirk use within its respective technological system, and will aid in our predictions of behavioral decisions surrounding technological organization (Bleed 1986), technological risk (Austin and Mitchel 2009; Torrence 1983), and subsistence behaviors relevant to settlement and resource exploitation strategies (Anderson and Hanson 1988, Daniel 1996, 1998, 2001; Sassaman 1996; Sassaman et al. 1988; Wilkinson 2017a). By first examining the trajectory of a projectile points use-life through resharpening and without failures, an understanding of the reduction of utility through use can have a baseline for comparative and analytical purposes. With an underlying understanding of a Kirks use-life failure free, it will aid our evaluation of a Kirks role within a system where failures are imminent, and where behavioral decisions around these eventual failures can be further assessed.

The patterns of debitage by size class illustrate that standard archaeological sampling of 1/4 of an inch will not capture even remotely a majority of the debitage residues from Kirk resharpening episodes. This is consistent with the previous findings of Towner and Warburton's experiment (1990). While episodes of preform or point manufacture have a good chance of being identified from the retrieval of larger debitage, behaviors such as bifacial resharpening would require the implementation of smaller sampling sizes. While the focus of this portion of the experiment was on analysis of the debitage itself, spatial characteristics of such behavioral residues were not evaluated. Spatial analysis of behavioral residues has been a principle of archaeological research for decades, though more recently in the Southeastern United States increased focus has been placed on close interval spatial sampling and the analysis of interpolated spatial data from such sampling (Cable and Cantley 2002, 2005a, 2005b, 2006; Cantley and Cable 2002; Wilkinson et al. 2018). These approaches aid in identifying behavioral spaces which represent spatially defined occurrences of lithic reduction or residues from other behaviors, whether as an activity area wherein multiple reduction episodes occurred, or singular episodes of reduction in isolation. The 1/8 of an inch size class represents an ideal threshold for such evaluations as the intersection between count and weight percentages demonstrate the relative comparability between interpolated spatial evaluations based on debitage counts and weights.

Table 4: Evaluation of Aggregate Debitage Residues per Size Class.

All Stages	**Total Count**	**Percentage of Count**	**Total Weight**	**Percentage of Weight**
1 inch	8	0.03	66.82	8.24
1/2 inch	114	0.37	162.13	20
1/4 inch	727	2.37	184.22	22.72
1/8 inch	9641	31.4	279.66	34.5
1/16 inch	20207	65.83	117.89	14.54
Total Greater Than ¼"	849	***2.77***	413.17	***50.96***
Total Less Than ¼"	29848	***97.23***	397.55	***49.04***
All Resharpening Stages	**Total Count**	**Percentage of Count**	**Total Weight**	**Percentage of Weight**
1 inch	0	0	0	0
1/2 inch	0	0	0	0
1/4 inch	3	0.03	0.15	0.14
1/8 inch	2783	29.32	66.2	62.72
1/16 inch	6706	70.65	39.13	37.1
Total Greater Than ¼"	3	***0.03***	0.15	***0.14***
Total Less Than ¼"	9489	***99.97***	105.33	***99.86***
Total Greater Than 1/8"	2786	***29.35***	66.35	***62.9***
Total Less Than 1/8"	6707	***70.65***	39.13	***37.1***

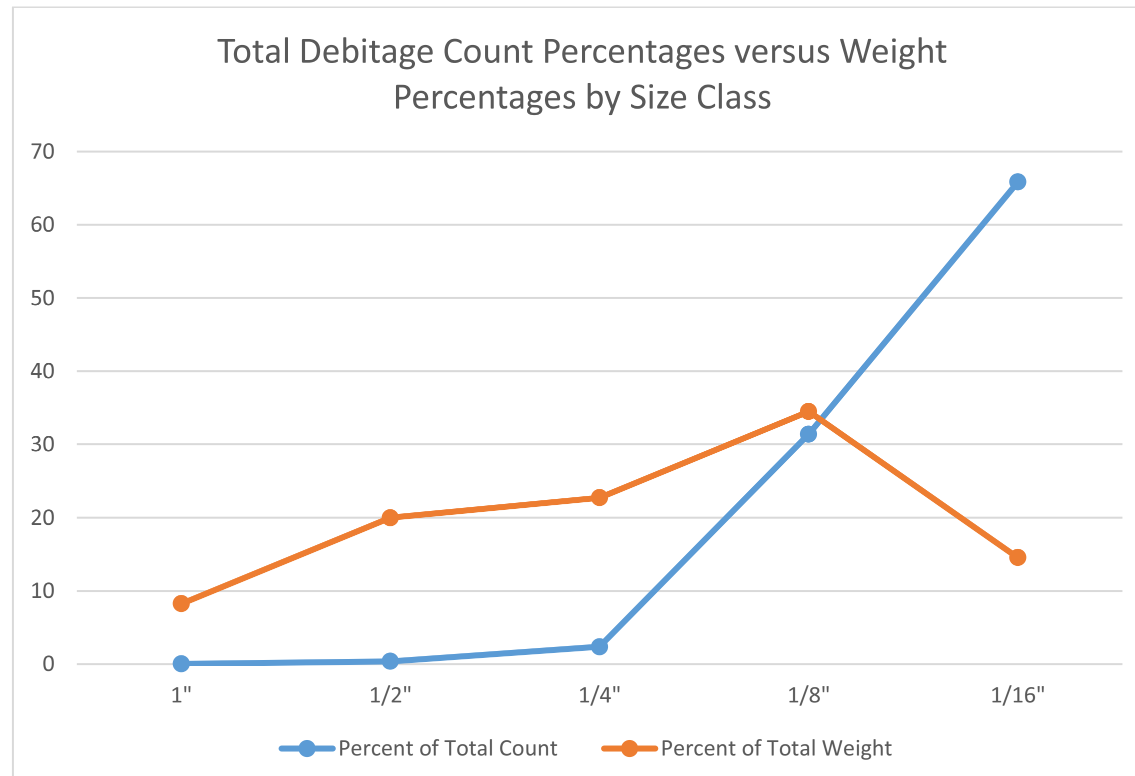


Figure 16: Total Aggregate Debitage Count and Weight Evaluations from all Production and Resharpening Stages.

As the focus of this experiment was not on debitage residue patterning, but rather characteristics of size and mass, intensive evaluation of spatial patterning of the resulting debitage was not undertaken. However, throughout the experiment the author did pay attention to the resulting patterning from individual stages of reduction. Figure 17 is an illustration of the debitage patterning left after reducing one of the specimen blanks into a preform. Note the yard stick that illustrates the scale of this debitage patterning. While the debitage was not quantified spatially, the resulting patterning from this reduction event appears to illustrate that the majority of the debitage exists within a 36" x 36" area in front of where the knapper was seated. This patterning is more evident as the size and quantity of debitage is abundant due to the stage of reduction. For episodes of resharpening, the resulting pattern was much smaller and as the debitage itself was small a photograph would not illustrate as evident a pattern as seen in Figure 17. Due to the small size of resharpening debitage, the author found it pointless to allow resharpening debris to fall to the mat as the majority of the resharpening debitage was captured in the leather hand-pad used as a base for pressure flaking the Kirk bifaces. Assuming in instances where debitage retrieval is irrelevant and the resulting debitage from resharpening events are allowed to drop straight from the knapper's hand-pad, it is a reasonable assumption that the majority of such residues could inhabit space approximately 18" x 18". This theoretical behavioral space might be identified under ideal contextual and sampling circumstances if post-depositional site processes effecting such residues are minimal, and archaeological sampling is adequate. Regardless of spatial sampling, adequate screen size for retrieving such residues would need to be implemented for such residues to be identified in the first place.

Analysis of the debitage from the Kirk corner notched hafted biface resharpening experiment has sought to evaluate the visibility of such residues as it relates to standard archaeological sampling strategies, and the aggregate patterning of resharpening events. While an intensive evaluation of spatial patterning was not undertaken, by evaluating the size of the resulting resharpening debris it is abundantly apparent that such behaviors would not be identified on archaeological sites or properly evaluated based on current practices. Further experimentation of other tool types and reduction, reconditioning, or resharpening behaviors would enhance the present study in order to evaluate flake characteristics that might distinguish such behaviors from each other.

Conclusions

The experimental evaluation presented here has demonstrated that the resharpening trajectory of Kirk corner notched hafted bifaces can withstand on average 9.3 cycles, and when failures from use are absent represent an ideal expectation as to the tools practical use-life. Evaluations of the changes Kirks undergo from such resharpening, has demonstrated that the blade portion sustains the most attrition as it is the functional portion of the tool which requires maintenance. The resulting debitage evaluations from this experiment have also demonstrated that residues from such resharpening behaviors are abundant, though rarely identified during standard archaeological sampling. To echo the recommendation previously made by Towner and Warburton (1990:318), it seems crucial that 1/8 of an inch sampling be utilized in archaeological investigations if resharpening residues (especially from Kirk hafted bifaces) are to be recovered.

As further studies into Early Archaic lifeways proceed, further attention should be placed towards not only identifying small resharpening residues, but also the spaces within which they inhabit. Behavioral spaces significantly aid in the evaluation of occupational residues on an archaeological site, and with the advances in computing technology are becoming easier and easier to undertake. By recovering even small resharpening residues with careful methods of spatial sampling, our understanding of short-term Early Archaic occupations across the landscape will be greatly enhanced. Such focused investigations will aid in identifying and evaluating the specific behaviors that are crucial for the testing of many

Figure 17: Representation of the Behavioral Space created by the Production of a Kirk corner notched Hafted Biface.

previously proposed Early Archaic mobility and subsistence models. Furthermore, with such focused investigations sites that have previously been written off or disregarded as insignificant due to the apparent lack of artifact density and diversity, will be able to produce meaningful data for the evaluation of Early Archaic socio-technological systems.

As this present study has focused on one component of a complex technological system, so too should additional studies focus on individual components of prehistoric technological systems. Such focused studies will further enhance our understanding of the relationship individual components have with one another within the overall system, and aid in our interpretation of the behavioral decisions that negotiate their respective capabilities and limitations.

References

Anderson, David G. and Glenn Hanson
1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Valley. *American Antiquity* 53(2): 18-32.

Anderson, David G. and Kenneth E. Sassaman
1996 *The Paleoindian and Early Archaic Southeast*. Tuscaloosa, Alabama; The University of Alabama Press.

Anderson, David G. and Joseph Schuldenrein
1983 Early Archaic Settlement on the Southeastern Atlantic Slope: A View from the Rucker's Bottom Site, Elbert County, Georgia. *North American Archaeologist* 4(3):177-210.

Austin, Robert J. and Scott E. Mitchell
1999 *Archaeological Investigations at Jeanie's Better back (8LF54), an Early Archaic Site in Lafayette County, Florida*. Report prepared for

Florida Department of Transportation, District Two Lake City, Florida. Southeastern Archaeological Research, Inc.
2009 Reconstructing the Life Histories of Bolen Hafted Bifaces from a North Florida Archaeological Site. *Early Georgia* 38(1):3-27.

Broyles, Bettye J.
1971 *Second Preliminary Report: The St. Albans Site, Kanawha County, West Virginia*. Report of Archaeological Investigations No. 3. West Virginia Geological and Economic Survey, Morgantown, West Virginia.

Cable, John S.
1996 Haw River Revisited: Implications for Modeling Terminal Late Glacial and Early Holocene Hunter-Gatherer Settlement Systems in the Southeast. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 107-148. University of Alabama Press, Tuscaloosa.

Cable, John S. and Charles E. Cantley
2002 Prehistoric Site Structure and Settlement. In *Archaeological Data Recovery at Sites 38SU136/137 and 38SU141, Poinsett Electronic Combat Range, Sumter County, South Carolina*, edited by C.E. Cantley and J.S. Cable, pp. 235-342. Report prepared for U.S. Army Corps of Engineers, Savannah District. New South Associates, Stone Mountain, GA.
2005a *Phase II Archaeological Testing and Evaluation of Nine Prehistoric Sites in Cumberland and Hoke Counties, North Carolina*. Palmetto Research Institute Publications in Archaeology No. 8, Irmo, SC.
2005b A Methodological and Theoretical Approach to the Investigation of Hunter-Gatherer Settlement Systems: A Case Study from Fort Bragg, North Carolina. Paper presented at the Southeastern Archaeological Society Conference. Columbia, SC.
2006 *Phase II Archaeological Testing and Evaluation of Six Prehistoric Sites in Hoke County, Fort Bragg, NC*. Final Report submitted to the National Park Service and the Department of the Army by Palmetto Research Institute, Irmo, SC.

Cantley, Charles, and John Cable
2002 *Archaeological Data Recovery at Sites 38SU136/137 and 38SU141, Poinsett Electronic Combat Range, Sumter County, South Carolina*. Report prepared for U.S. Army Corps of Engineers, Savannah District. New South Associates, Stone Mountain, GA.

Chapman, Jefferson C.
1985 Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. In *Structure and Process in Southeastern Archaeology*, edited by Roy S. Dickens, Jr. and H. Trawick Ward, pp. 137-153. The University of Alabama Press.

Charles, Tommy, and Christopher R. Moore
2018 *Prehistoric Stone Tools of South Carolina*. Publication of the Piedmont Archaeological Studies Trust, Inc. Glendale, South Carolina.

Claggett, Stephen R. and John S. Cable
1982 *The Haw River Sites: Archeological Investigations at Two Stratified Sites in the North Carolina Piedmont*. Report R-2386. Jackson, Mich.: Commonwealth Associates Inc.

Coe, Joffrey Lanning
1964 *The Formative Cultures of the Carolina Piedmont*. Transactions of the American Philosophical Society Vol. 54, Part 5. The American Philosophical Society, Independence Square, Philadelphia.

Daniel, I. Randolph, Jr.
1996 Raw Material Availability and Early Archaic Settlement in the Southeast. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 84-91. University of Alabama Press, Tuscaloosa.
1998 *Hardaway Revisited: Early Archaic Settlement In The Southeast*. Tuscaloosa; University of Alabama Press.
2001 Stone Raw Material Availability and Early Archaic Settlement in the Southeastern United States. *American Antiquity* 66(2): 237-265.
2002 Early Archaic Tool Assemblage. In *G.S. Lewis-East: Early and Late Archaic Occupations along the Savannah River, Aiken County, South Carolina*. pp. 45-71. Savannah River Archaeological Research Papers 12. Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Flenniken, J. Jeffrey and Anan W. Raymond
1986 Morphological Projectile Point Typology: Replication Experimentation and Technological Analysis. *American Antiquity* 51(3):603-614.

Frison, George C.
1968 A Functional Analysis of Certain Chipped Stone Tools. *American Antiquity* 33(2):149-155.

Goodyear, Albert C., III
1974 The Brand Site: A Techno-Functional Study of a Dalton Site in Northeast Arkansas. *Research Series Number 7*. Arkansas Archaeological Survey.
2014 Paleoindians in COWASSEE: Time, Typology, and Raw Material Selection. *South Carolina Antiquities* 46:3-20.

Goodyear, Albert C., William Radisch, Ruth Wetmore, and V. Ann Tippitt
2004 A Kirk Corner-Notched Point Cache from the Nipper Creek Site (38RD18), South Carolina. *Current Research in the Pleistocene* 21:42-44.

Jelinek, Arthur
1976 Form, Function, and Style in Lithic Analysis. In *Cultural Change and Continuity: Essays in Honor of James Bennet Griffin*, edited by C. Cleland, 10-33. New York: Academic Press.

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Indiana University Press, Bloomington and Indianapolis.

Kimball, Larry R.
1992 Early Archaic Settlement and Technology: Lessons from Tellico. In *Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective*, edited by David G. Anderson, Kenneth E. Sassaman, and Christopher Judge, pp. 143-181. Columbia: Council of South Carolina Professional Archaeologists.
1996 Early Archaic Settlement and Technology: Lessons from Tellico. In *The Paleoindian and Early Archaic Southeast*, editors, David G. Anderson and Kenneth E. Sassaman, pp. 149-186. University of Alabama Press, Tuscaloosa.

Michie, James L.
1996 The Taylor Site: An Early Occupation in Central South Carolina. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 238-269. Tuscaloosa, Alabama; The University of Alabama Press.

Sassaman, Kenneth E.
1996 Early Archaic Settlement in the South Carolina Coastal Plain. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 58-83. University of Alabama Press, Tuscaloosa.

Sassaman, Kenneth E., Glen T. Hanson, and Tommy Charles
1988 Raw Material Procurement and the Reduction of Hunter-Gatherer Range in the Savannah River Valley. *Southeastern Archaeology* 7: 79-94.

Sassaman, Kenneth E.; I. Randolph Daniel, Jr.; and Christopher R. Moore
2002 *G.S. Lewis-East: Early and Late Archaic Occupations along the Savannah River, Aiken County, South Carolina*. Savannah River Archaeological Research Papers 12. Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Smith, Edward E. Jr.
1995 The Swan's Landing Site (12HR304): An Early Archaic (Kirk Horizon) Site in Harrison County, South-Central Indiana. *Midcontinental Journal of Archaeology* 20(2):192-238.

Steponaitis, Vincas P., Jeffrey D. Irwin, Theresa E. McReynolds, and Christopher R. Moore

2006 Stone Quarries and Sourcing in the Carolina Slate Belt. *Research Report No. 25*, University of North Carolina, Chapel Hill.

Sweat, Jeremy L.
2009 Lithic Resource Survey of the Upper Little River Drainage: Raw Material Availability and Use at the Townsend Sites. Master's Thesis, Department of Anthropology, University of Tennessee, Knoxville.

Torrence, R.
1983 Time Budgeting and Hunter-Gatherer Technology. In *Hunter-Gatherer Economy in Prehistory*, edited by G. Bailey, pp. 11-22. Cambridge University Press, Cambridge.

Towner, Ronald H. and Miranda Warburton
1990 Projectile Point Rejuvenation: A Technological Analysis. *Journal of Field Archaeology* 17(3):311-321.

Tuck, James A.
1974 Early Archaic Horizons in Eastern North America. *Archaeology of Eastern North America* 2(1): 72-80.

Wetmore, Ruth Y. and Goodyear, Albert C.
1986 *Archaeological Investigations at Nipper Creek (38RD18): An Archaic Fall-Line Site*. Research Manuscript Series 201. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

White, Andrew A.
2012 The Social Networks of Early Hunter-Gatherers in Midcontinental North America. Unpublished Ph.D. dissertation, Department of Anthropology, The University of Michigan, Ann Arbor.
2016a Social Implications of Large-Scale Demographic Change during the Early Archaic Period in the Southeast. Paper presented at the Southeastern Archaeological Society Conference, Presented in Symposium: Hunter-Gatherer Societies of the Late Pleistocene and Early Holocene Southeast. Athens, GA.
2016b A Preliminary Analysis of Haft Variability in South Carolina Kirk Points. *South Carolina Antiquities* 48:41-53.
2019 A Comparison of Functional Variability Among Early Archaic Notched Points from the Lower Savannah River. *South Carolina Antiquities* 51:1-21.

Wilkinson, Joseph E.
2014 The Effects of Material Quality on Tool Form and Selection During the Early Archaic at the Johannes Kolb Site 38DA74. *South Carolina Antiquities* 46:65-75.
2017a Modeling Early Archaic Mobility and Subsistence: Evaluating Resource Risk across the South Carolina Landscape. Unpublished Masters thesis, Department of Anthropology, The University of South Carolina.
2017b The Southern Hardin in South Carolina. *South Carolina Antiquities* 49:1-23.
2018 Across the Coastal Plain from Savannah to Santee: Early Archaic Mobility and Raw Material Utilization in South Carolina. In *Early Human Life on the Southeastern Coastal Plain*, edited by Albert C. Goodyear and Christopher R. Moore. University of Florida Press, Gainesville.

Wilkinson, Joseph E., Audrey R. Dawson, David E. Rigtrup, and Alaina Williams McDaniel
2018 *Data Recovery at Two Sites: Micro-Interval Shovel Testing, Excavation Units, and Geomorphology of Sites 38RD843 and 38RD837/841/842/844, U.S. Army Garrison, Fort Jackson, South Carolina*. Report prepared for U.S. Army, Fort Jackson. Applied Research Division, South Carolina Institute of Archaeology and Anthropology, University of South Carolina.

Artifacts from the Landrum Stork Site (38RD288)

Carl Steen

In 2014 Terry and Steve Ferrell donated their collection of sherds collected at ten pottery production sites in South Carolina to the McKissick Museum at the University of South Carolina. The Ferrell's learned about Edgefield pottery in the 1960s, and were among the first to begin to study it in detail. Steve is a potter, and visited every site he could find to collect sherds for reproduction experiments. In the early 1990s he moved to Edgefield, and opened the Old Edgefield Pottery. Until he retired in 2013 Steve kept his shop in downtown Edgefield open to tourists, students, pottery collectors, archaeologists, and just about anyone that passed by.

In the early 2000s Terry Ferrell opened an antique store in the next block over, and they made half of the showroom into a museum. The basement provided ample space for the storage of 140 boxes of potsherds. Later these were moved to an old house in Pottersville, just outside of town. Without climate or rodent control the paper tags and cardboard boxes deteriorated. Our first job was to wash artifacts, sort, re-bag and re-box them. This was done at McKissick by the author and a paid assistant, with the help of volunteers. These artifacts are now safely stored and available for research.

In the Ferrell sherd collection there were 34 boxes of artifacts from the Landrum-Stork site (38RD288). This 19^{th}-20^{th} century pottery and brickyard was in Forest Acres, a town encompassed by the city of Columbia (Figure 1). Production ceased at the brickyard and pottery by the 1960s. This collection was made in 1972 by Tom Turner, a potter who had learned of the site in 1969 when he was stationed at Fort Jackson (Tom Turner, personal communication 2019:). In 1972 Tom was teaching at Clemson when he was told that the site was to be bulldozed to make way for the construction of a condominium complex (Figure 2, 3, 4). He contacted the State Historic Preservation Office and archaeologists at USC, but no one wanted to take the project on, so he took the initiative and salvaged what he could, employing friends and students. While professional archaeologists might frown on this behavior, and Tom says ceramic scholar Georgianna Greer took him to task over the issue, we can only thank him for saving what might be the only accessible collection from the site. We must also thank Steve and Terry Ferrell for keeping it together in SC, and for donating it to McKissick.

When the brickyard was destroyed the kiln chimney, encased in a brick sheath in the 1930s, was left standing (Figure 5). A monument placed in front of it stated that this was the:

"Original Site of Landrum Brick &
Pottery Co.
1832-1911
R. M. Stork Brickyard
1811-1970
Original Chimney Erected in 1800s &
Encased Within Present Chimney in 1935

Abner Landrum was instrumental in introducing the manufacture of alkaline glazed stoneware in the Old Edgefield District of SC around 1810 (Steen 2011; Calfas 2013; Baldwin 1993). He was a man of many talents. He was a physician and had a general interest in science. His experiments with grafting pecan and walnut trees led to the modern papershell pecans that we enjoy. He established the town of Pottersville, about a mile east of Edgefield, and encouraged artisans and craftsmen to settle there. He built a pottery there by about 1812, and he also owned a print shop. As the Nullification Crisis gathered steam in the late 1820s he started a Pro-Union newspaper, the Pottersville Hive. He was invited to move to the state capitol to publish the Columbia Free Press and Hive in 1831. This was in opposition to the Nullification movement, which was made up of Southerners who wanted to nullify the Constitution and end the

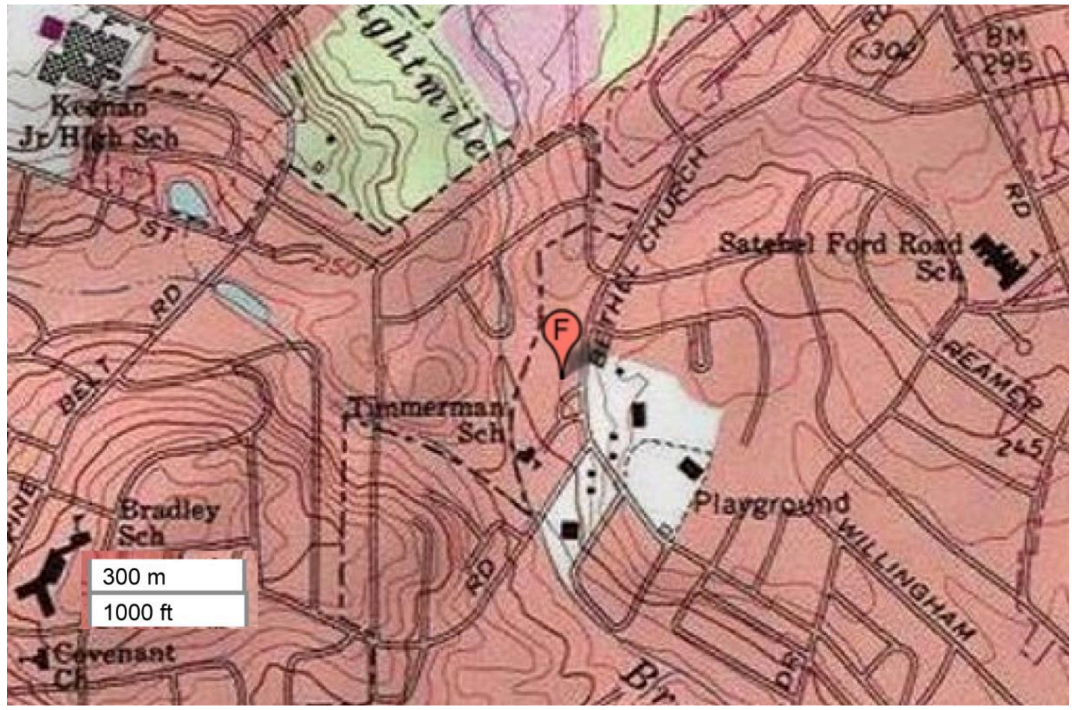


Figure 1: USGS topo showing former site location. Possible drainage discussed in text is above the word "Satchel" (center right).

Figure 2: Tom Turner collecting artifacts in 1969.

Figure 3: Coffee pot in the field.

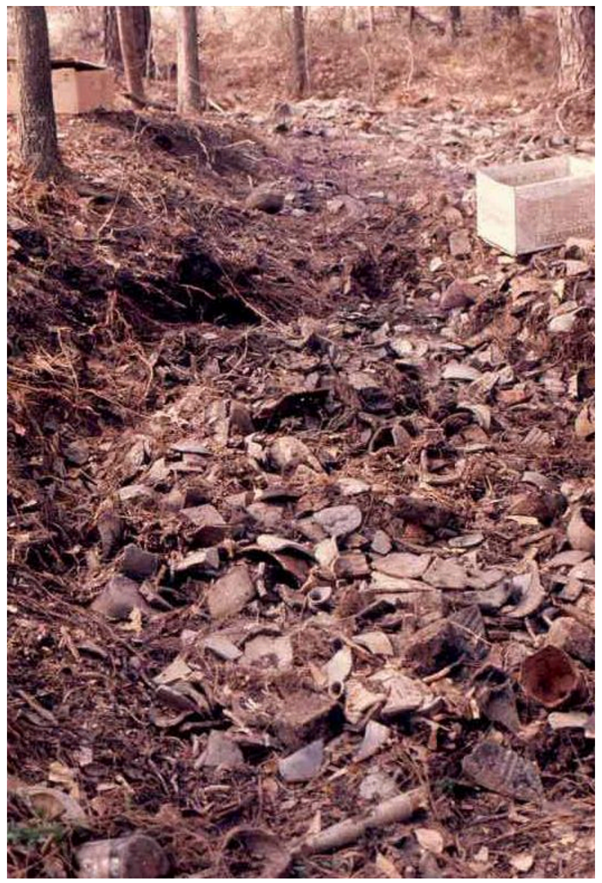


Figure 4: Waster scatter.

Union. Military intervention threatened by President Andrew Jackson defused the crisis, and compromise was achieved (Freehling 1966).

Whether he built a pottery in 1832 is unclear. One would think that running a weekly newspaper and printing business would be a full time job. The plaque at the site gives the date 1832, but the basis in documentation for this assertion is not known. He continued to publish his newspaper until 1837 so he may have delayed building a pottery operation until then (Montgomery 2010:9). His obituary states this clearly: "He retired to the Sandhills about 1837, and from that period to his death was engaged in the occupation of a planter and the manufacture of pottery-ware." (*Edgefield Advertiser*, May 11, 1859). Some sherds illustrated below feature the refined green alkaline glaze Landrum used in Edgefield (Figure 18, for example), while others have less refined glazes and bodies (Figure 10, for example). In the 20th century Edward and William Stork adopted the Albany slip glaze (Figure 17, for example), so a succession from father to son to grandchildren is evident.

One of his children, Palissy, would have been in his early 20s in 1831, and could conceivably have run the pottery. However, in 1859 the city directory shows that he was a printer, as do other entries. Although everyone of working age doubtlessly helped out when necessary, the only child of his that is clearly known to have become a potter, Linneaus Landrum, was not born until 1829, so the operation would not have been built for him.

Slaves were involved in pottery making in Edgefield, but Abner Landrum was never a major slave owner either there or in Columbia. For instance, in 1820 he owned a girl less than 14. In 1830 he held two young men between 10 and 36, and a female between 10 and 24 years of age. In Columbia in 1840 he held one adult woman and two children. In 1850 he owned women aged 20 and 17, and a boy who was eleven years old. So although the Landrums did own slaves, they appear to be domestic help rather than field workers or potters. Landrum was well acquainted with Abolitionists in the North who may have influenced his thinking on the issue (Steen 2011; Smedley 1883).

An 1886 land plat shows a 39 acre tract of land that was labeled "reserved for Dr Landrum 25^{th} June 1844" (Figure 7). The word "pottery" is found in this area at what appears to be the location of the brick factory that was destroyed in the 1970s. According to the Federal Census the pottery was in operation in 1850. In 1846 Abner Landrum applied to the state legislature for assistance in establishing a porcelain making operation (Steen 2011). This suggests new construction at about the time that his son Linneaus, who took over the operation when Abner died in 1859, would have been coming of age and seeking a career. Tom Turner believes that the early kiln was located a hundred or so feet from the later one, under a condominium, unfortunately. So it is likely that a pottery has been at the site of the brick factory since at least the mid-1840s, and the date of 1832, while questionable, is not inconceivable.

The factory destroyed in 1972 was then known as the R.M. Stork brickyard. John J. Stork Jr. married Abner's daughter Juliette. He was the son of John J. Stork, who immigrated from Germany in 1837 (National Archives; Selby 1970:136). Brothers Abram and John Stork immigrated together. Abram opened a grocery store, and John, a tavern. Both practiced other trades during their lives as well, with John being listed as a shoemaker in 1850. Whether he made pottery in Germany is unknown, but his family did originate in the Rhine region, home of the Westerwald stoneware tradition. Immigrant potters from Germany such as the Staubes brothers, who worked for John Seigler in Edgefield, came over at about the same time (Baldwin 1993).

John J. Stork Jr. was called a cabinetmaker at age 18 in the 1860 census. In 1870 he and his brother William H. Stork were working at the Landrum pottery. He had married Juliette Landrum, Linneaus's daughter, by this time, though she was called Martha J. Stork in the census, leading to some confusion. They were living with the Landrum's at the time. Their father John Sr. was a city councilman, and one of the party that surrendered Columbia to Gen. Sherman in 1865 (Moore 1993). He died in 1868 at age 55 (https://www.findagrave.com/memorial/106130643).

So, while it is possible that his family was involved in pottery in Germany, it appears that John J. Stork learned to make pottery working with his father-in-law, Linneaus Landrum. Robert Stork bought the operation around 1899, after Linneaus's 1891 death (Baldwin 1993:119) and the name changed to Stork Firebrick Works in 1911 (Montgomery 2010:15).

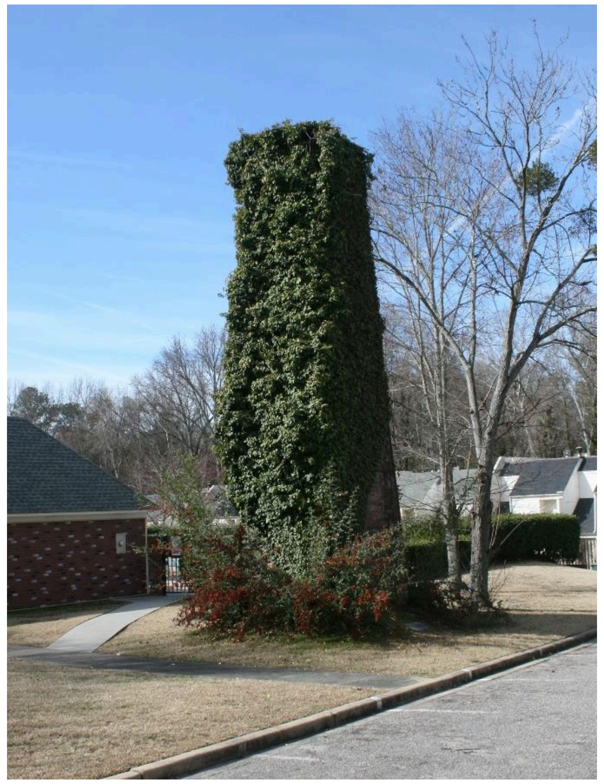


Figure 5: Landrum Stork brick kiln chimney. Brickyard Condominiums office and buildings in background.

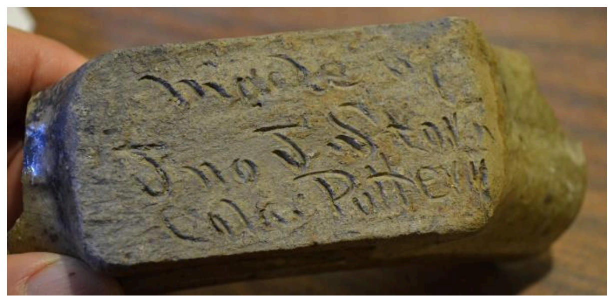


Figure 6: John Stork's signature.

A descendant stated in 1989 the Edward and Robert Stork had a pottery "just north of Linneaus's shop" (Baldwin 1993:119). This was probably the site of the later brick kiln. Again, time and landscape alteration intervened, and Tom Turner was not positive, but he believed that earlier materials were found to the west of the standing chimney, under a condominium building. So there may be another pottery site in the immediate area.

A sherd was found in the collection that has spurred this line of discussion. In this case we have a basal sherd inscribed "...on Upper Branch" (Figure 8). This is, presumably, part of the phrase "Made on Upper Branch." Eight Mile Creek runs north-south, and thus does not have an upper or lower branch. The 1886 plat shows a drainage running east from about where the word pottery is seen. The drainage splits, and on the upper branch the name J.J. Stork is seen. This is in about the same location as the Landrum Stork house, built by Abner Landrum in the 1850s and occupied by the Stork family until 1970. It is still standing and occupied, one of the oldest structures in Richland County.

The USGS topo maps and soil surveys do not show a significant drainage in this area, but the topo lines do suggest the presence of an intermittent drainage running to the east (see Figure 1). A descendant in Edgefield said that several potters in the area of her uncle's kiln would bring wares to fire periodically (Castille et al. 1988:A43). So, is it possible that pottery was made at the home site or elsewhere and then transported to the kiln for firing?

The clay used for the body often contained iron inclusions that ranged in size from fine to very coarse. These melted during the firing, resulting in speckling in general, but also in large meltouts and runs (Figure 11). Where the stoneware clay was obtained is unclear. In 1871 Landrum wrote of it being purchased at a brickyard on the banks of the Broad River at the bridge (Baldwin 1993:119). This would be where Highway 176 (River Drive) crosses today. It would seem that this would be a very iron-rich clay due to erosion in the Piedmont sending red clay sediment downstream. Based on casual observation while driving by, the clay at the brickyard that is there now appears to be very red, but it is possible that lighter colored clays are intermixed. Given the underlying geology it is even possible that primary clays are present, weathering from the gneiss and granite bedrock.

One commenter on a Columbia web site who grew up in the area, and remembered playing at the brick factory as a child in the 1960s, mentioned a "clay canyon where Trenholm Park is now" (http://columbiaclosings.com/wordpress/?p=321, accessed 8-11-14). Trenholm Park is within 200m of the brick factory. If the pottery shown on the 1886 plat is the same as the R.M. Stork factory the Trenholm Park area would have been on the Landrum property shown on the 1886 plat.

During the Civil War Linneaus Landrum sold jugs, jars and chamber pots to the Confederacy, but not bricks. In the 1880 census he is called a potter,

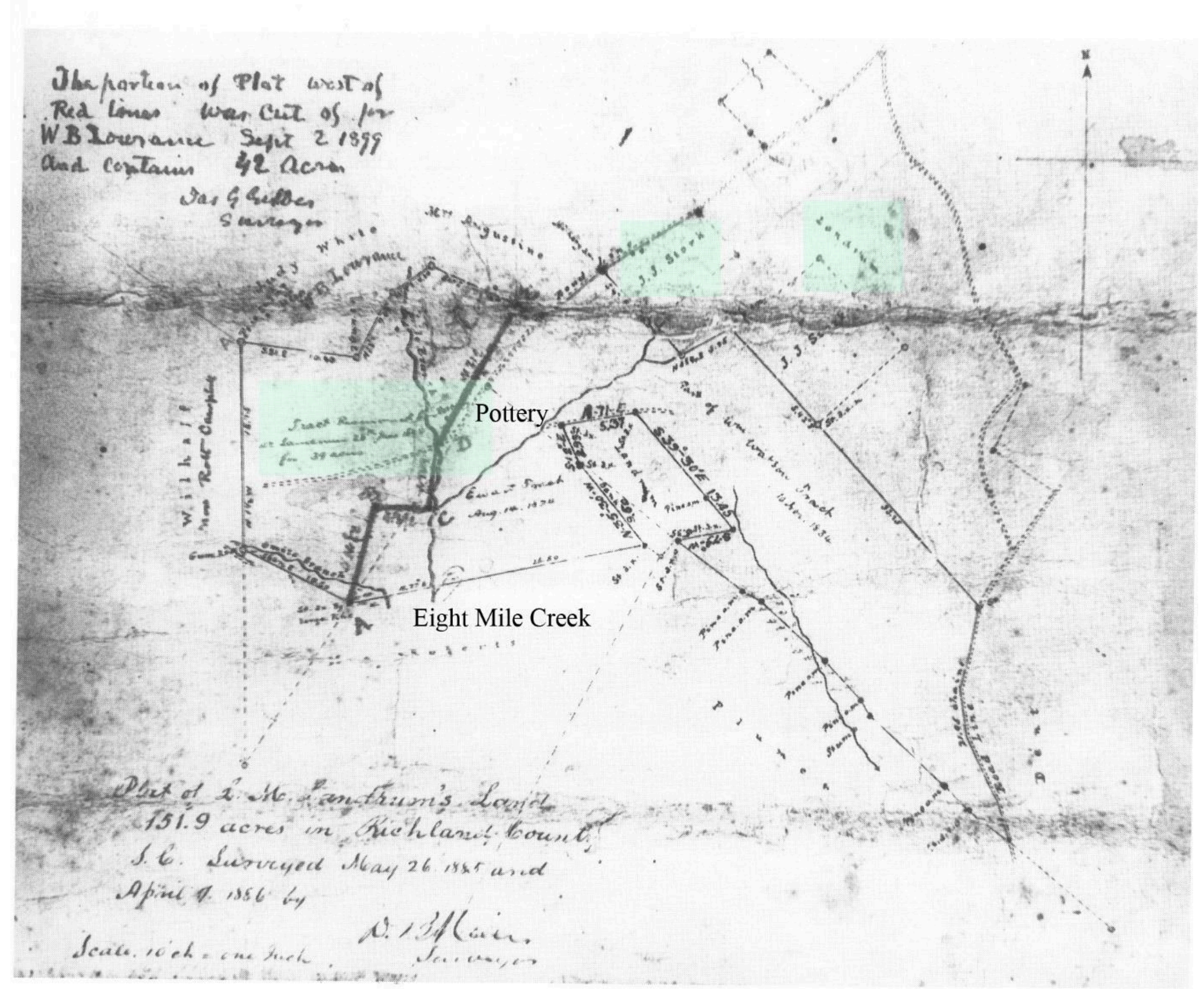


Figure 7: 1886 plat of Linneaus Landrum's property.

but by the 1880s he was concentrating on fire brick manufacture (Baldwin 1993). The business's focus had clearly turned to firebrick by the time of Linneaus's death in 1891. Firebrick is made from highly refractory, kaolin rich clay common in the Sandhills. The entire area is on Pelion series soils, which are formed in "loamy marine sediment" (Lawrence 1978). These soils consist of sandy topsoil about a foot thick, over numerous bedded layers of sandy clay. While stoneware clays are more plastic and harder to find, firebrick clays would be less demanding, and could have been mined locally. In fact, the presence of sand and quartz pebbles is a plus for firebrick, as it increases the melting point (Cardew 1969). Considering the cost and effort required to transport the amount of clay needed for making large amounts of brick it is likely that this location was chosen with that factor in mind.

No clay pits are identified on the modern USGS Fort Jackson North topographic map or on the 1940 or 1965 Killian Quadrangles. Construction of the park playing fields may have erased any trace of relatively small clay pits on the old landscape. A drainage runs into Eight Mile Branch just north of the brick factory which may be the "clay canyon" mentioned above. The topo lines indicate a drop of about 60 feet from the top of the hill to the creek. To a child this might seem like a vast canyon. Before this area was a park it also served as the county almshouse and was later home to county chain gangs. This suggests a low property value, which may be the result of clay mining.

The Artifacts

When the Ferrell Collection was delivered to McKissick it was stored in a variety of cardboard boxes that they had obtained from the local

Figure 8: Base inscribed "...on Upper Branch."

Figure 10: Storage jar with Key mark (right center).

Figure 9: Glaze example. Note the brown "meltouts".

Figure 11: Cream riser and churn lid with Key mark.

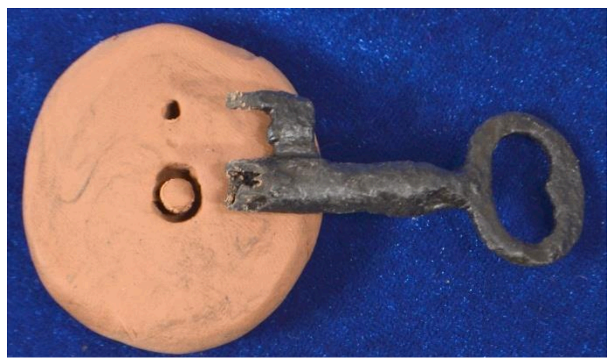


Figure 12: 19th century key and mark example.

supermarket. Our first job was to wash the sherds and repackage them. After we completed this task for the entire collection, I returned to do a basic catalog of the Landrum-Stork collection. This was not an in-depth analysis, but rather a quick job of sorting artifacts and quantifying them. As limited as it is this will guide future researchers and allow them to formulate research questions and goals.

The collection contains some interesting material that has not been seen at sites in Edgefield such as ring jugs, tablewares, and coffee pots with pinched integral spouts. A total of 3,191 items were cataloged. The majority of these were stoneware sherds, but the total includes kiln furniture, clay and glaze test pieces, and kiln debris.

Since the collection is mostly at the sherd level it is often difficult, if not impossible, to determine what sort of vessel a sherd represents. Jug bases and storage jar bases, for example, look the same for the most part. Body sherds from jugs and jars also look the same. Thus the most common vessel type for now is "Indeterminate."

Handles are more sensitive, but strap handles, which are usually found on jugs, and lug handles, which are usually found on jars, were both seen on deep bowl / pan forms. Rims are the most diagnostic sherds, so they take precedence in identifying vessels and vessel forms. The numbers presented here are not from an intensive analysis, and should be considered in relative terms. For example, 33 jug rims were identified, but no real effort was made to see if they mend. Thus the 33 rim sherds may represent 33 vessels, 25 vessels, or some other number. On the other hand, only three plates were identified, so it is clear, even without a precise number, that more jugs were made here than plates.

Makers marks, or production marks, were uncommon, but a little surprising. Collectors have long tied a mark made by impressing a skeleton key into the clay to the Landrum-Stork pottery (Figure 12, 13, 14). This leaves a round punctation and a second small squarish punctate where the turning bar of the key is found. With fifteen examples this is the most common mark.

The next most common mark, with thirteen examples, is a relief cross in circle. This looks like the mark a Phillips head screw would make if it was pressed into the clay. This came as a surprise because it is the most common mark seen at Abner Landrum's nephew B.F. Landrum's pottery in the Old Edgefield District (Steen 2016). This mark has been called the Landrum Cross. It was also seen at the John Landrum site. It has not been found in excavations at Pottersville, however, lending support to the idea that John or BF Landrum sent a worker to Columbia.

A sherd was found with an impressed E&W. This is the mark of Edward and William Stork, John's sons. Edward is notable for being the epitome of the itinerant potter, leaving Columbia and working in Mississippi, Alabama, and Georgia (Burrison 1983:172). He helped to establish the W.T.B. Gordy pottery, whose family continues to make pottery there today. Edward Stork's wife Hester remained in Columbia and owned several properties on what became Fort Jackson, including at least one clay pit (38RD899). Firebrick and structural debris was found at the site, but no evidence of a kiln was seen (Steen and Braley 1992). A recent revisit with base archaeologist Chan Funk confirmed this assessment.

Vessels

Bowl / Pan. Following Georgianna Greer's vessel typology what I call the "Bowl / Pan" form includes wide mouth vessels that are wider at the rim than they are tall (Figure 19). Wide mouth jars, sometimes called crocks, are taller than they are wide. Only a single example was clearly a crock. Pans have mostly straight, uncurved walls, while bowl walls are more curved. Pans tend not to be glazed on the top of the rim, while bowls usually have glaze there. Pan rims tend to be simple, and rounded, though more complex "Ogee curve" (Greer 1981:65) forms are also seen (Figure 17). Wide flat rims are sometimes seen on kitchenwares, but they are also strongly associated with chamber pots.

Bowls and pans served numerous functions. Nearly every kitchen would have a bowl for mixing and serving foods (slop or serving bowls), and for separating cream from milk (called cream risers). The majority of our bowl / pan sherds are from this sort of utilitarian vessel. These are usually the most common vessel found at South Carolina pottery sites.

A form I called shallow pans was fairly common. These are small, around 10cm in diameter at the rim, and 50-70mm tall. Two examples were considerably wider, at 20cm and 22cm in diameter. The latter was 75mm tall, while the former was

Figure 13: Impressed cross mark.

Figure 14: Sherd inscribed "187..." Probably John Stork.

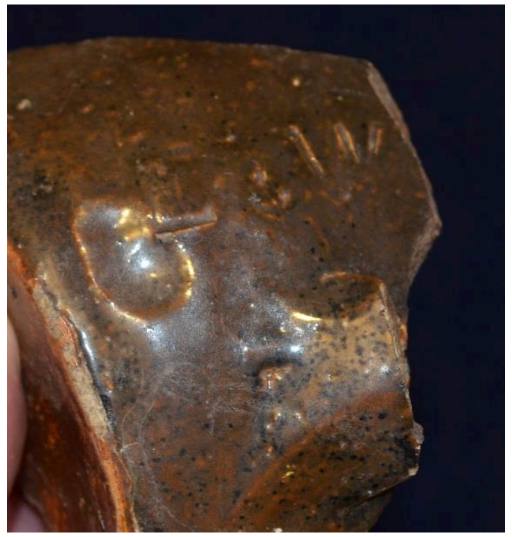


Figure 15: E&W Stork mark. Used in the 20th century. Note Albany slip glaze.

Figure 16: E&W Stork cream riser (Courtesy Jason Shull).

Figure 17: Pan forms. Note the refined light glaze.

55mm tall. In many cases no glaze is visible, but usually drips and runs of glaze are present, suggesting a poor body / glaze fit. The smaller examples may be bases for flowerpots, while the larger ones may have served other utilitarian functions – dog bowls, for instance.

One bowl and lid fit together (Figure 20). This is relatively fancy, having a constricted pedestal base that is segmented. The lid also has a segmented rim, and similar bands are seen on top of the rim, and at the base of the body. This vessel has a well fired light green glaze similar to the earlier, more refined glazes used at Pottersville and the John Landrum site. This suggests it was made by Abner Landrum. It probably served as a sugar bowl, or a similar table function.

An unglazed bowl had a short pedestal base, though this is more randomly notched. The rim of this vessel is rolled over, leaving a groove under it. This vessel is about 140mm in diameter at the rim, tapering to an 80mm diameter base. It is about 90mm tall. A hole under the rim would allow it to be suspended, suggesting it was a hanging flowerpot. It is not complete enough to say whether enough holes were present for this purpose, or whether the base had a drainage hole. Whether the lack of glaze is intentional or a firing error is unclear.

Of the 604 sherds from bowl/pan forms only two were marked. This was the key mark.

Jugs. Jugs are vessels with tightly constricted rims. In South Carolina they usually have strap handles that are pulled into shape, rather than extruded. Altogether 104 sherds were identified as being from jugs. It is difficult to say anything definitive based on the sherds for the most part because of their size. Tom Turner and his Army friend, Bert Sharpe, donated two jugs to McKissick that Tom felt was made by Abner Landrum in Columbia (Figure 19).

An important dichotomy is the method of handle attachment. Later, more cylindrical vessels have the handles attached directly to the rim (Figure 21, 22), while earlier, more ovoid vessels have the handle attached to the body (Figure 23). Two types of rim were noted. The first is a bottle type rim with two rings (Figure 20). Compared to this type of rim at Pottersville and other Landrum sites in the Old Edgefield District these are crude and poorly formed. The other rim form is a variant on the band or collar style (Figure 23). These range from examples that are rounded, to flat, to tapering in one direction or the other. The bottle form always had a separate handle, while the band form had both separate and attached handles.

Intensive analysis has not been conducted, but as a broad generalization it can be stated that the jugs found here tend to be smaller than the ones found in Edgefield. There they begin at 1/2 gallon and can be as large as five or more gallons. Here one gallon would appear to be the largest, and some appear to be no larger than a quart.

Marks were found on seven jugs. Five had the cross in circle and two had the key mark. Of these one was on a base, and the rest were on the vessel shoulder. Both marks are found on the attached handle vessels, so there does not appear to be an indicator of age. Another jug shoulder had incised writing (Figure 16). What was present was the word "jug," a separating line, and the date "Apri... 187...". This appears to be John J. Stork's handwriting.

Coffee / Tea Pots. Coffee and tea pots were found at 38AK172, the Hitchcock Woods pottery, and at 38AK497. In both cases, and for that matter in most cases where the form is found, spouts tend to be long and detached from the body. Here the spout is integral (Figure 24). This is a small vessel that would only hold a few cups of water.

Coffee Cups / Mugs. Seven sherds that were clearly from coffee mugs were identified (Figure 25). These had straight sides that flare slightly. Cups and mugs have been found at sites in the Old Edgefield District, but neither here nor there in great numbers. However, they were of great value to refugees of the destruction of Columbia in 1865. Mary Whilden wrote that the hospital at the Barhamville Academy had wares from a pottery nearby, which would have been the Linneaus Landrum pottery. She received a stoneware pitcher, bowl and "two or three cups" which was their" sole supply of crockery, except such pieces that we picked up after the fire among the ruins (Whilden 1887:17).

Ring Jugs. The ring jugs found at the site are interesting as well. First, this is the only 19th century site in South Carolina known by the author to have produced the form, which is more of a

Figure 18: Lidded bowl, probably made by Abner Landrum.

Figure 19: Pots donated to McKissick by Tom Turner and Bert Sharpe. Attributed to Abner Landrum.

Figure 20: Rims collected by Tom Turner. Note the similarity to the rims on the donated pieces.

Figure 21: A late 19th century Linneaus Landrum or Stork jug (Courtesy Jason Shull).

Figure 22: Landrum-Stork jug waster donated by a neighborhood resident. Note the clay condition at the base and the failure of the glaze to mature.

Figure 23: Landrum-Stork jug rim. Note separation of handle and rim, and refined color. This is probably a mid-19th century piece.

Figure 24: Coffee pot. Note integral spout.

Figure 25: Cup forms.

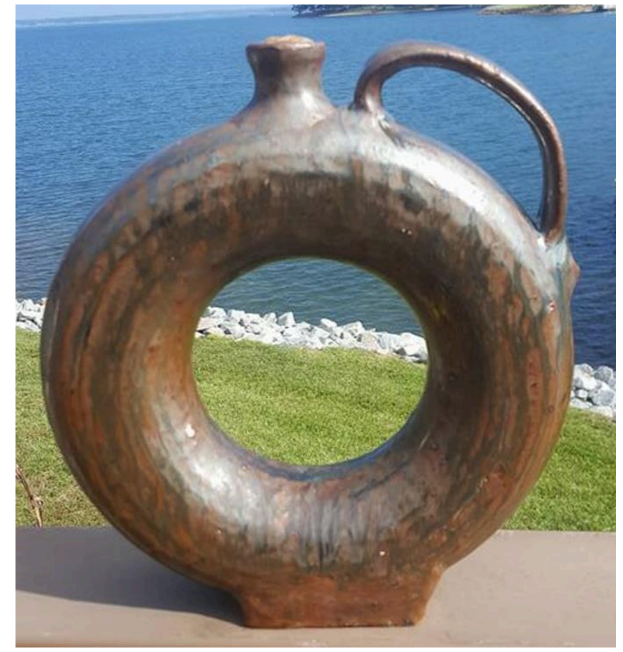


Figure 26: Ring jug (Courtesy Jason Shull).

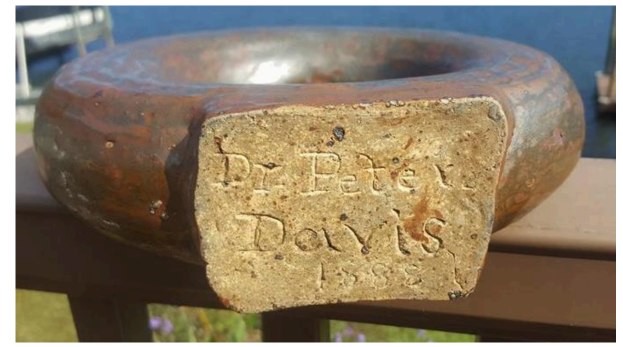


Figure 27: Dedicated to "Dr. Peter Davis 1888" (Courtesy Jason Shull).

Figure 28: Tobacco Pipe.

Figure 29: Ink well fragments.

novelty than a utilitarian vessel. Some claim they were used as "Confederate" canteens, ignoring the fact that most vessels would not hold more than a pint of liquid at most. Next, examples from the site are clearly labeled by location, and the maker, John. J. Stork (Figure 7). One vessel in a private collection that recently came to light was inscribed on the base with a name: Dr. Peter Davis (Figure 26, 27). This inscription is clearly in the hand of John Stork (see Figure 6).

Newspaper research showed that Dr. Davis was, in fact, an herbal healer or root doctor. Or a "hoo doo" practitioner, as the newspaper put it (The State March 28, 1893). Davis had been arrested for fraud in Orangeburg after supposedly casting a spell on two Germans in Orangeburg. Although hoo doo and root medicine are usually associated with African Americans it is important to remember that people of all colors and nationalities have traditions of casual magic such as carrying a rabbits foot for good luck, wearing amulets with images of saints for protection, and so on. The status of ring jugs in these practices is unknown, though many spells involve imbibing a cure (Puckett 1918). The anomalous shape of the vessel may have added emphasis to the ritual.

Flower Pots / Garden Ware. Stoneware flowerpots were identified. Large ornamental garden pots were also manufactured, and can be seen at the Historic Columbia Foundation's Hampton-Preston site (John Sherrer, personal communication 2014).

Tobacco Pipe. A single tobacco pipe was found (Figure 28). This is a molded, unglazed stub stemmed pipe. These seem to have been made in small numbers at most of the potteries in Edgefield, so finding one here is not entirely unexpected.

Ink Well. Fragments of five small inkwells were identified. This is a vessel form that is unusual on 19th century potteries in South Carolina, but it is not surprising to see it on a site so close to the city and its governmental offices and schools. Ink would be purchased in large seal-able bottles and transferred to these smaller vessels as necessary.

Summary

In 1969 a young potter serving in the Army at Fort Jackson discovered the Landrum-Stork pottery. A few years later he returned as it was being destroyed. At that time no one was studying South Carolina stoneware, and he was barely able to find out anything at all about the potters. Nevertheless, he recognized the significance of the site and, along with a couple of friends and volunteers, salvaged what he could. He passed this material along to Steve and Terry Ferrell, and they maintained it for 40-odd years. Steve used some pieces in his pottery shop, and Terry displayed examples in his museum, but no in-depth study of the material had been conducted.

After the Ferrell Collection was donated to McKissick, I was able to take a quick look at the artifacts and made a rough catalog. I photographed notable pieces for posterity as I went, but formal recording remains to be done.

It appears that the site has been thoroughly disturbed. Tom Turner's 1972 photos show a typical uneven slope that led to Eight Mile Branch. Landscapers scooped out a flat terrace to build the condos on, and in all likelihood the waster piles and bricks from the kiln were used as fill. Eight Mile Branch was channelized at the same time, and in the walls of the streambed bricks and rocks are common. After every rainstorm local mudlarks collect a few sherds, but further archaeology does not seem possible. However, if there is another site in the neighborhood it may well have survived.

In summary, Abner Landrum and his family moved to Columbia in 1831, and he established a pottery factory no later than about 1847. His son Linneaus operated the pottery until his death in

Table 1: Summary of Artifacts from the Landrum Stork site in McKissick's Ferrell Collection.

Vessel Type	# sherds	Comment
Ant trap	1	Also seen at B.F. Landrum
Bowl	1	
Bowl / crock	1	
Bowl / Pan	657	
Bowl with lid	2	Possible sugar bowl
Bowl with wide flat rim	12	Possible chamber pot rims
Coffee Pot	6	Mended sherds not counted separately
Coffee cup	7	Only clearly identifiable vessels here.
Cup	5	
Flowerpots	24	Only clearly identifiable vessels here.
Gardenware	49	
Inkwell	5	
Jug	104	
Kiln debris	28	
Kiln furniture	46	
Lids	63	
Tobacco pipe	1	
Pitcher	3	
Plate	4	
Ring jug	44	
Storage jar	29	
Storage jar / churn	33	With lid ledge rim
Indeterminate	32	
Indeterminate, hollowware	1915	
Indeterminate, hollowware, strap handle	111	
Indeterminate, hollowware, lug handle	8	

1891, when it was taken over by his brother-in-law John J. Stork. The Storks moved into brick making and ran the establishment until the 1960s, when all but the kiln chimney was bulldozed for development.

Acknowledgements

Thanks to Tom Turner and Bert Sharpe for salvaging these artifacts, to Terry and Steve Ferrell for keeping the collection intact, and to McKissick Museum for giving them a permanent home, and allowing them to be studied. Thanks to Jason Shull for sharing his knowledge of Columbia pottery, and to Corbett Toussaint for sharing her historical research.

References Cited

Primary Sources
Jason Shull, Personal Communication
Corbette Toussaint, Personal Communication
Edgefield Advertiser, May 11, 1859
The State March 28, 1893
National Archives *Passenger Lists of Vessels Arriving at New York, New York, 1820-1897.* Microfilm Publication M237, 675 rolls. NAI: 6256867. Records of the U.S. Customs Service, Record Group 36. National Archives at Washington, D.C.
https://www.findagrave.com/memorial/106130643
http://columbiaclosings.com/wordpress/?p=321

Secondary Sources
Baldwin, Cinda
1993 *Great and Noble Jar: Traditional Stoneware of South Carolina*. University of Georgia Press, Athens, Ga.
Burrison, John
1983 *Brothers in Clay: The Story of Georgia Fold Pottery*. University of Georgia Press, Athens, GA.
Calfas, George
2013 Nineteenth Century Stoneware Manufacturing At Pottersville, South Carolina: The Discovery Of A Dragon Kiln And The Reinterpretation Of A Southern Pottery Tradition. PhD Dissertation, University of Illinois, Champaign-Urbana, Champaign-Urbana, Ill
Cardew, Michael
1969 *Pioneer Pottery*. St. Martins Press, New York, NY.
Castille, George and Cinda Baldwin, Carl Steen
1988 An Archaeological Survey of Alkaline Glazed Stoneware Production Sites in the Old Edgefield District, South Carolina, McKissick Museum, and the Institute of Archaeology and Anthropology, University of South Carolina, Columbia, S.C.
Freehling, William W.
1966 *Prelude to Civil War: the Nullification Controversy in South Carolina, 1816_1836.* Harper and Row, New York, NY.
Greer, Georgianna
1981 *American Stonewares: The Art and Craft of Utilitarian Potters*. Schiffer Publishing, Exton, Pa.
Lawrence, Carl
1978 *Soil Survey of Richland County, SC*. USDA Soil Service, Washington, DC.
Montgomery, Warner M.
2010 *Forest Acres (Images of America)*. Arcade Publishing, Columbia, SC
Moore, John H.
1993 *Columbia and Richland County: A SC Community, 1740-1990*. The University of SC Press, Columbia, SC
Puckett, Newbell Niles
1926/1975 *Folk Beliefs of the Southern Negro*. Negro Universities Press, New York, NY.
Selby, Julian A.
1970 *Memorabilia and Anecdotal Reminiscences of Columbia, SC*. R.L. Bryan Co., Columbia SC
Smedley, R. C.
1883 *History of the Underground Railroad in Chester and Neighboring Counties of Pennsylvania*. Published by the author, Lancaster, Pa
Steen, Carl
2011 Alkaline Glazed Stoneware Origins. *South Carolina Antiquities* 43(1&2):21-32.
Steen, Carl
2014 Archaeology at the Rev. John Landrum Site 2011-2013. *South Carolina Antiquities*, 46(1):21-34.
Steen, Carl
2016 Archaeology at the B.F. Landrum Stoneware Kiln Site: 38 AK496. Diachronic Research Foundation, Columbia, S.C
Steen, Carl and Chad Braley
1992 *Another Step Towards a Long Term Land Use History for the Midlands of South Carolina: An Archaeological Survey of Selected FY92 Timber Harvest Tracts at Fort Jackson*. Southeastern Archaeological Services, Athens, Ga., and Diachronic Research Foundation, Columbia, SC
Whilden, Mary
1887 *Recollections of the War, 1861-1865*. The State Publishers, Columbia, SC

A Last Glacial Maximum Radiocarbon Date from Snake Hole, Allendale County, South Carolina

Albert C. Goodyear and Mark J. Brooks

Understanding the formation and ages of alluvial terraces in archaeological research for early prehistory is critical to reconstructing landscapes and discovering Pleistocene age sites. In 1990 the authors were exploring the eastern side of the Savannah River valley near the edge of the escarpment on what was then Sandoz Chemical Corporation property. This property was eventually owned by Clariant Corporation and today by Archroma U.S, Inc. This same property was previously the location of an archaeological survey focusing on chert quarries (Goodyear and Charles 1984).

We cored subsurface deposits in these wetlands in 10cm levels using a Dutch gouge auger with a 5cm diameter, 1 meter long core barrel with a split-spoon, extension rods, and a T-handle. The deepest of these tests called Auger Test 2, was some 200 m west of the base of the escarpment and was 3.20 m in depth (Figure 1). After getting through the modern roots we encountered alluvial deposits of various textures as field described here (Table 1). At 260-270 cmbs degraded organics were encountered which were subsequently radiocarbon dated at 18,570 +/- 100 BP (Beta-48176). This elevation is considered the second terrace or T2 in geological nomenclature (Waters et al. 2009).

This ancient terrace area which today exists as a swale-like wetland was studied again in 2000 by a team of geologists from the University of South Carolina and Coastal Carolina University (Goodyear 2000). Their goal was to attempt to indirectly date the upper alluvial deposits at the nearby Topper site (Figure 1) by cross correlating the stratigraphy (Karabanov et al. 2002). A series of nine vibracores (TA 1-9) were taken across the old T2 surface (Figure 1) in order to characterize the stratigraphy (Figure 2). One vibracore (SH-1) was taken near our Auger Test 2. They reported that these cores stratigraphically correspond with the upper layer of Topper or what we have called the White Pleistocene Sands which house the upper preClovis age sediments (Goodyear and Sain 2018; cf. Waters et al. 2009). Three radiocarbon dates were obtained from the vibracores dating 37,810 yr BP +/- 570 yr, 34,210 yr BP +/- 370 yr, and 25,330 yr BP +/- 130 yr (Figure 2). They also included the 18,570 BP date which is the date reported here.

The relevance of the Snake Hole date of 18,570 +/- 100 yr BP is that it shows during the Last Glacial Maximum the Savannah River was flowing at the toe of the T-2 elevation, and during flood stage was capable of depositing the sandy preClovis age alluvium at the Topper site. According to the original Sandoz topographic map (Figure 1), the vibracores were done within the 80' foot contour elevation which runs through the Topper site. This date is reported here for the first time with its map location and core description.

Acknowledgements

We thank Mike Anderson then of Sandoz Chemical Corporation for providing the funds to date the sample. The work of Clariant Corporation was critical in creating a road to access the vibra coring work at Snake Hole 1. A huge debt of gratitude is due Eugene Karabanov and Doug Williams of the University of South Carolina geology department and Paul Gayes at Coastal Carolina for the vibra coring. Eugene Karabanov provided the core descriptions. Thomas Stafford of Stafford Laboratories conducted the radiocarbon dating of the vibracores. A grant was provided by the Archaeological Research Trust to bring Lucinda McWeeny to the study site to identify plant remains. And last to all the serpents that dwell in

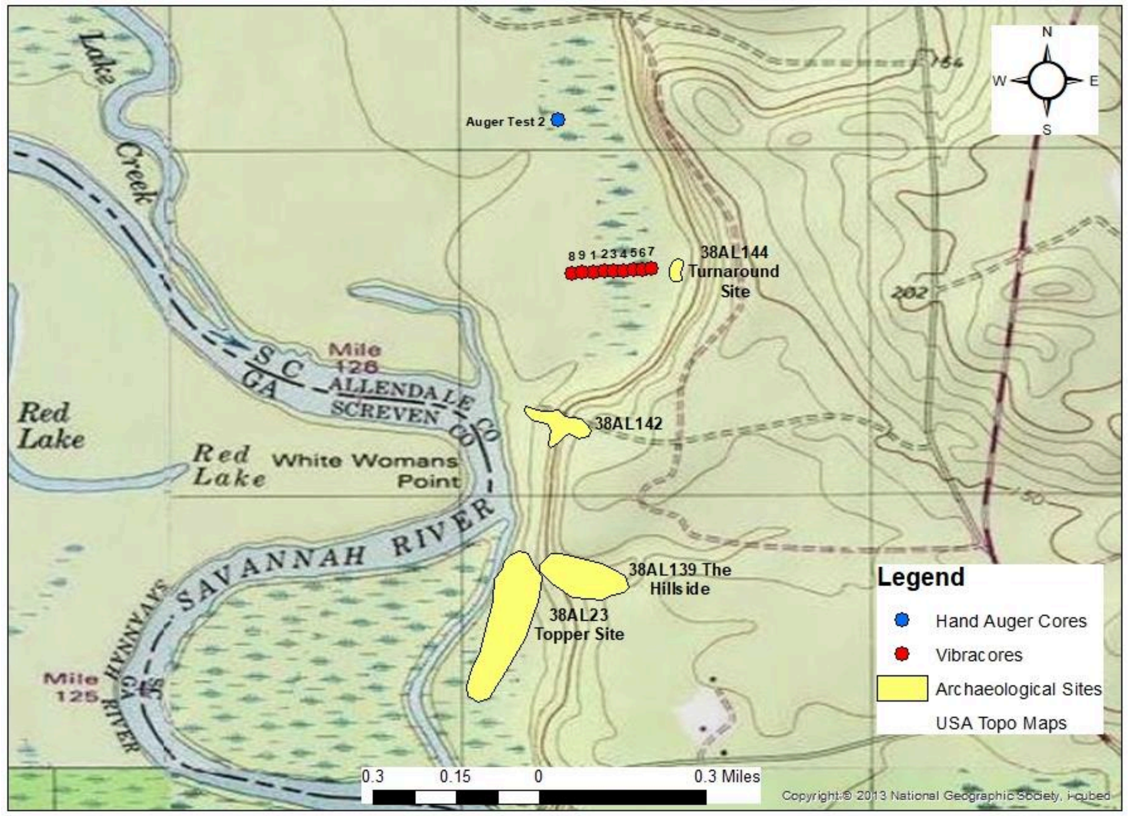


Figure 1: Location of Auger Test 2 in Snake Hole and the 10 vibracores collected by geology team(Karabanov et al. 2002).

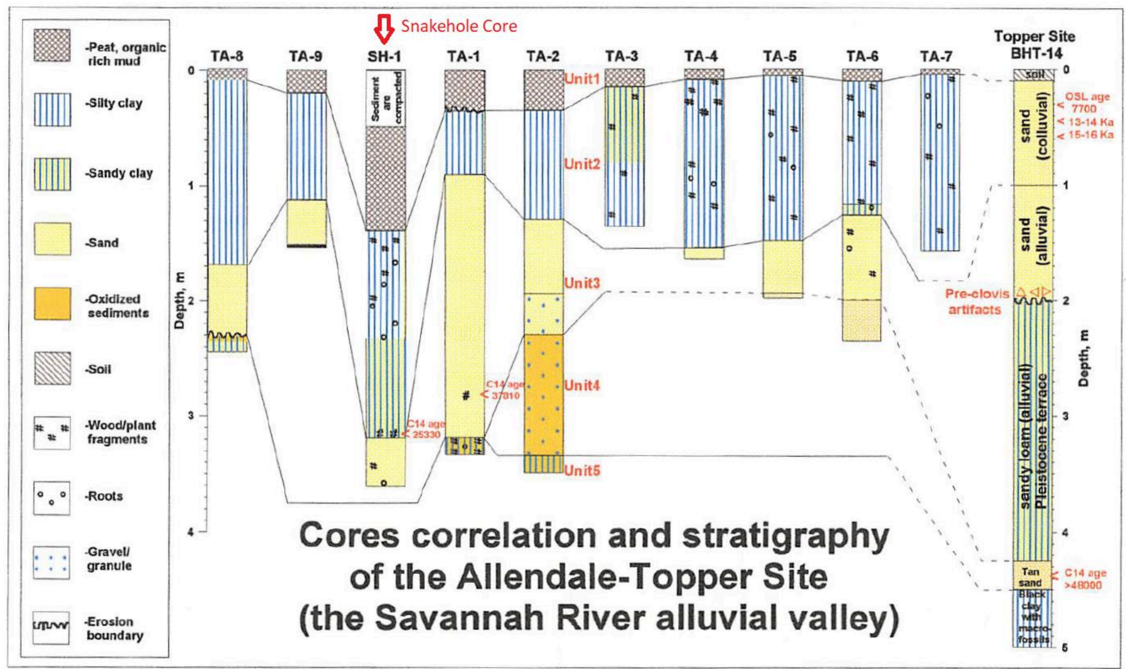


Figure 2: Lithological descriptions of the 10 vibracores taken in 2000 across the T2 floodplain north of the Topper site.

Table 1: Summary descriptions of Snake Hole sediments in Auger Test 2, (3/23/90).

Soil Depth	Soil Description
0-70 cmbs	Rooted, peaty silt-clay, a little fine sand.
70-180 cmbs	Rooted, gray-green, plastic, micaceous clay.
180-190 cmbs	Gray clay with abundant very fine sand, roots.
190-210 cmbs	Light gray, very fine sand, with abundant muscovite mica, no roots.
210-240 cmbs	Light, tan-gray, very fine sand with abundant muscovite and biotite mica.
240-250 cmbs	As above, but sufficient clay for stickiness.
250-260 cmbs	Very fine, light gray sand.
260-270 cmbs	Sand with degraded organics (14c date of 18,580 +/- 100 BP).
270-280 cmbs	Light gray, clean sand with fine mica, no organics.
280-320 cmbs	Light gray, clean sand with fine mica, no organics.

the Snake Hole vicinity, the place got its name deservedly.

References

Goodyear, Albert C.
2000 Topper Site: Results of the 2000 Allendale Paleoindian Expedition. *Legacy*, Vol. 5, No. 2, December, pp, 18-25. Newsletter of the South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Goodyear, Albert C. and Tommy Charles
1984 *An Archaeological Survey of Chert Quarries in Western Allendale County, South Carolina*. Research Manuscript Series 195. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Goodyear, Albert C. and Douglas A. Sain
2018 The Pre-Clovis Occupation of the Topper Site, Allendale County, South Carolina. In *Early Human Life on the Southeastern Coastal Plain*, edited by Albert C. Goodyear and Christopher R. Moore, pp. 8-31. University Press of Florida, Gainesville.

Karabanov, Eugene, Brandy Glett, Angie McManus, Albert Goodyear, Paul Gayes, Douglas Williams and the Allendale Coring Group
2002 Sedimentary Framework for the Allendale-Topper Site. Poster program presented at the North-Central Section (36th) and Southeastern Section (51st), GSA Joint Annual Meeting (April 4, 2002), Lexington, Kentucky.

Waters, Michael R., Steven L. Forman, Thomas W. Stafford, and John Foss
2009 Geoarchaeological Investigations at the Topper and Big Pine Tree Sites, Allendale County, South Carolina. *Journal of Archaeological Science* 36:1300-1311.

Early Archaic Projectile Point Typologies in South Carolina: Are Side and Corner Notched Points Contemporary?

Albert C. Goodyear, Andrew A. White, and Joseph E. Wilkinson

As in the rest of the Southeast, researchers of South Carolina prehistory use projectile point typologies to organize sequences of culture history and frame questions about change through time. For the Early Archaic a general temporal distinction between earlier side notched points (such as Taylor, Big Sandy, and Hardaway side notched) and later corner notched points (generally referred to as Kirk) has been accepted for the last five decades (Coe 1964; Michie 1966; Charles and Moore 2018:21-30). The shift from side notching to corner notching in the Southeast was part of a wider pattern of technological change that extended across much of the Eastern Woodlands (see Tuck 1974). The recognition that side notched and corner notched points tend to differ in age across the Eastern Woodlands is based on several lines of evidence: (1) the radiocarbon record; (2) stratigraphic relationships between the two point forms; and (3) the existence of "closed" assemblages that contain either side notched or corner notched points rather than a mixture of the two forms.

Based on radiocarbon dates, there is general agreement that the widespread Kirk corner notched horizon first recognized by Tuck (1974) dates to the period 9500 to 8800 RCYBP (e.g., see Chapman 1976; 1985:145-149; Daniel 1998:3; Justice 1987; White 2016, 2019). Across the Eastern Woodlands, the Kirk horizon is preceded by a variety of side notched point forms (e.g., Big Sandy, Thebes, and Taylor) that tend to date to the period 10,300-9500 RCYBP (Anderson and Sassaman 2004, 2012; Driskell 1996; Sherwood et al. 2004; Stafford and Cantin 2009).

While rare, stratigraphic relationships between side and corner notched point forms during the Early Archaic do exist. At the James Farnsley site (12HR520) in southern Indiana, the Thebes/St. Charles component was "stratigraphically overlain by a series of Kirk cluster occupations" (Stafford and Cantin 2009:296) and above the Early side notched zone. At the Icehouse Bottom site (40MR23) in east Tennessee, Chapman (1973:49-51) described side notched and "deep corner notched" points similar to St. Charles (*aka* Plevna or Dovetail) in strata below the Kirk component (see also Kimball 1996). The temporal precedence of side notched points relative to Kirk points is also consistent with the stratigraphy at the Hardaway site (see Daniel 1998:25-27). At Modoc Rock Shelter (11R5) in Illinois, side notched points classified as Graham Cave side notched were found stratigraphically below points assigned to the Kirk corner notched cluster (Ahler and Koldehoff 2009:209-210).

Finally, the existence of apparently unmixed side and corner notched components in good context supports the temporal distinctiveness of the two point forms. If side and corner notched points were strictly contemporary during the Early Archaic period, one would not expect to encounter sites with large assemblages containing only one point form and not the other (in other words, the two point forms would be expected to frequently co-occur even in closed assemblages). In fact, there are many examples of sites that contain only one of the two point forms. Horizon 2 at the Twin Ditch site (11GE146) in Illinois contained several Thebes and St. Charles points, but no Kirk points (Morrow 1996). The Ceasars Archaeological Project in southern Indiana recorded distinct, buried side notched and corner notched components (Stafford and Cantin 2009). Buried deposits at the Swan's Landing site (12HR304), also in southern Indiana, produced 29 Kirk points and no side notched points (Smith 1995).

An Early Archaic side notched to corner notched sequence has been called into question by excavations in Florida that suggest

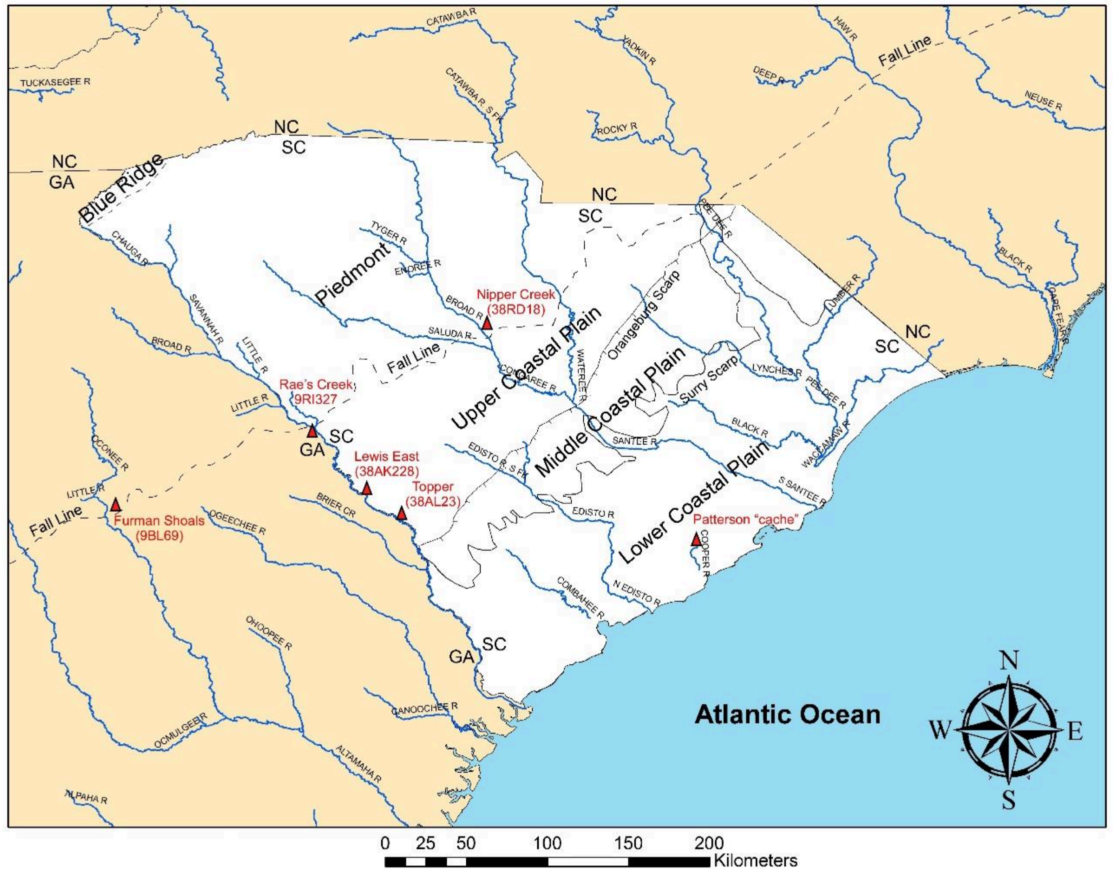


Figure 1: Regional locator map of sites with closed assemblages of Early Archaic points in the South Atlantic region.

contemporaneity among side notched and corner notched forms of Bolen points. Pevny et al. (2018:233), for example, state that "It is clear that side and corner notched Bolen points are contemporaneous at Florida's earliest EA sites." This assertion is based on the stratigraphic co-occurrence of side and corner notched forms at two sites (8LE2105 and Page-Ladson) in northern Florida (Faught et al. 2003; Goodwin et al. 2013).

The interpretation of the Florida data as contrary to the side notched to corner sequence for which there is positive evidence across much of the Eastern Woodlands suggests that examination of the temporal framework in which we view Early Archaic points in South Carolina is prudent. Is there evidence for contemporaneity of side and corner notched forms in South Carolina, or is the record in South Carolina consistent with the temporal distinctness of the forms suggested by the record in the remainder of the Eastern Woodlands? Understanding how differences in projectile point notch placement relate to time is critical to using lithic assemblages to investigate changes in Early Archaic societies over a time span of at least 1,000 years.

Evidence from South Carolina

As discussed above, three lines of evidence suggest that the lithic technologies of the Early Archaic period are characterized by side notched to corner notched sequence of point forms across much of the Eastern Woodlands: radiocarbon data, stratigraphic relationships, and closed assemblages that contain only one point form. Unfortunately, radiocarbon dates for the Early Archaic in the South Atlantic region and sites with secure stratigraphic contexts are rare.

There are, however, several sites in South Carolina (Figure 1) with reasonably closed Early Archaic lithic assemblages. The assemblages from these sites are consistent with the generally accepted Southeast-wide side notched to corner

notched projectile point sequence, as they contain projectile points of one kind or another rather than a mixture of forms.

The Topper Site (38AL23). Topper is a multicomponent site centered on a terrestrial outcrop of Coastal Plain chert known as Allendale Coastal Plain chert, located on the east bank of the Savannah River (Goodyear and Charles 1984). Perhaps best known for its pre-Clovis and Clovis occupations, there is an easily recognized Early Archaic component there represented primarily by Taylor side notched points. Continuous excavations on the terrace portion of the site (Figure 2) have yielded several Taylor points in hand-excavated 2x2 m units. This resulted in being the largest contiguous excavation block on the terrace and was done over several seasons primarily to provide a safe opening to go down deeper into the Pleistocene zones in search of pre-Clovis artifacts. In 2006 this block was covered by a pole barn building with a permanent roof to protect it from the elements. The excavation protocol was to dig a 2m unit in 10cm levels until reaching 60 cm when digging was done in 5cm levels and usually by 1m units. This resulted in good stratigraphic control of Early Archaic and Clovis occupations.

A total of six Taylor points (Figure 3) were found in seven locations including one refit (Table 1) which, through back plotting, revealed a recognizable buried occupation surface which follows the slope of the present day ground surface (Figure 4). A fragment of a magnetite "egg stone", aka dimpled stone, was also present. Burial of this surface and earlier Clovis and subsequent Archaic occupations occurred through slope wash from the immediately adjacent hillside (Figure 2). Figure 5 shows the horizontal distribution of these artifacts. The Early Archaic occupation of Topper is especially significant in that it is represented by almost exclusively Taylor side notched points. (Figure 6). Due to the particular history of occupation, this fortuitous situation allows for great clarity in viewing a pure side notched assemblage which is presumed to be earlier than Kirk.

The G. S. Lewis-East Site (38AK228). The G. S. Lewis East site is located on the Savannah River Plant near the confluence of Upper Three Runs Creek and the Savannah River (Figure 1). It was

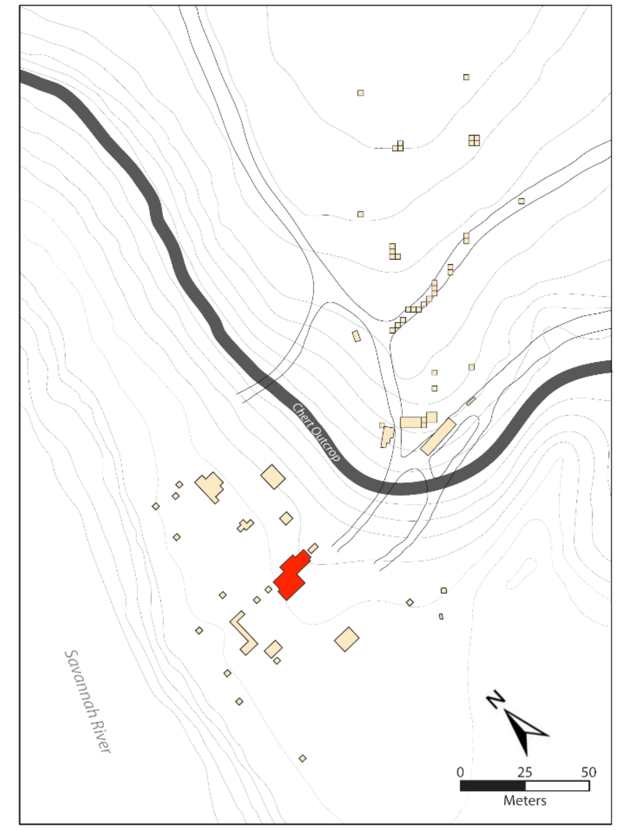


Figure 2: Location of block where Taylor points were excavated in the terrace area of the Topper site.

excavated in 1984 under the direction of Glen T. Hanson who was the manager at that time of the Savannah River Archaeological Research Program with the South Carolina Institute of Archaeology and Anthropology, University of South Carolina. The excavation totaled 376 m^2 which included a nearly pure Kirk corner notched assemblage (Figure 7). The analysis and final report were prepared by Kenneth E. Sassaman, I. Randolph Daniel, Jr., and Christopher R. Moore (2002). The site was also featured in an article by David G. Anderson and Glen T. Hanson published in American Antiquity (1988) examining Early Archaic settlement strategies along the South Atlantic Slope.

A total of what are described as 33 Kirk/Palmers were found within a 20cm thick zone. Other typical Early Archaic tools such as end and sidescrapers, bifacial preforms, and related production debris were found as well as two Edgefield scrapers, a ground metavolcanic celt and hone, and a chipped stone adze. One quartz side

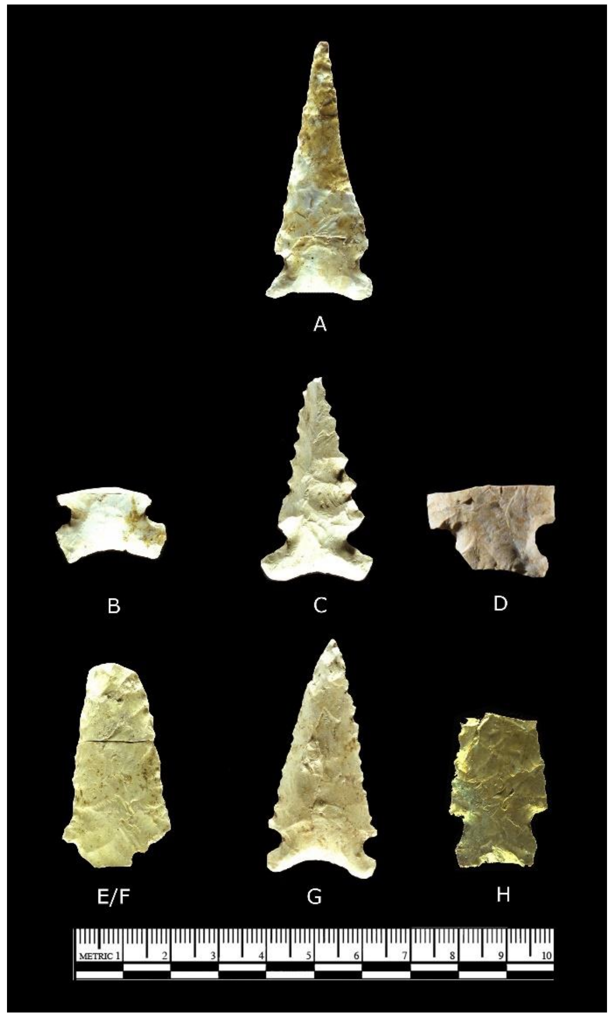


Figure 3: Taylor points excavated in the block in the terrace area of the Topper site.

notched point was also found. With the possible exception of the latter quartz point, no other side notched artifacts were found except the two Edgefield scrapers which are traditionally considered Taylor-related artifacts due to the side notching. However, this has not been conclusively established and the Lewis East site is considered by some as showing they lasted into the Kirk corner notched period.

The Lewis-East Kirk corner notched points present a wide array of resharpening and basal fractures and repairs (Figure 7). Even so the surviving shoulders are usually as wide if not wider than the basal widths which is typical of Kirks where the corner notching normally removed a portion of the preform base. In contrast to side notching which originates on the lower blade margin, this usually results in the base being as wide or wider as the shoulders (cf. Figure 6). Glen Hanson was aware of the often major alterations of a Kirk due to resharpening and recovery of broken blades and basal elements. His previously unpublished illustration reproduced here as Figure 8 provides a visual model of the hypothetical pathways a modified Kirk could take along various paths.

The Nipper Creek Site (38RD18) Kirk Cache. The Nipper Creek Kirk corner notched point cache (Figure 9) was discovered in 1986 during a University of South Carolina field school (Goodyear et al. 2004). Nipper Creek is a prehistoric and historic multicomponent site (Figure 1) located in an extensive sand deposit which had been mined for a golf course (Wetmore and Goodyear 1986). Stripping of the upper layers of sand from one area of the site partially exposed a cluster of corner notched points.

Early Archaic projectile point caches are fairly rare in the Southeast and may represent the artifacts surviving from unpreserved human burials. The raw materials represented among the six points is also instructive. Five of the points are made from high quality rhyolites suggestive of origins in the Uwharrie Mountains area of North Carolina. The sixth point is made from what has been called Ridge and Valley chert found in eastern Tennessee.

The Doug Patterson "Cache". The five Kirk corner notched points from this private collection were discovered by a hobby diver named Doug Patterson in the Cooper River. He found them in the Cooper after hurricane Hugo came through South Carolina in 1989. The discovery was first recorded by Tommy Charles in 2001 as part of his state-wide private collections survey. Charles took a photo which is pictured here (Figure 10). They appear to be made from Coastal Plain chert of the Allendale type. The haft areas of the points look very similar. Two of them are 100mm or more in length indicating an early stage of tool life. In March of 2016, the senior author had an opportunity to interview Patterson about the circumstances of his find. He said he found them over an area about 20 feet in diameter from a depression in the hard river bottom nicknamed the Honey Hole.

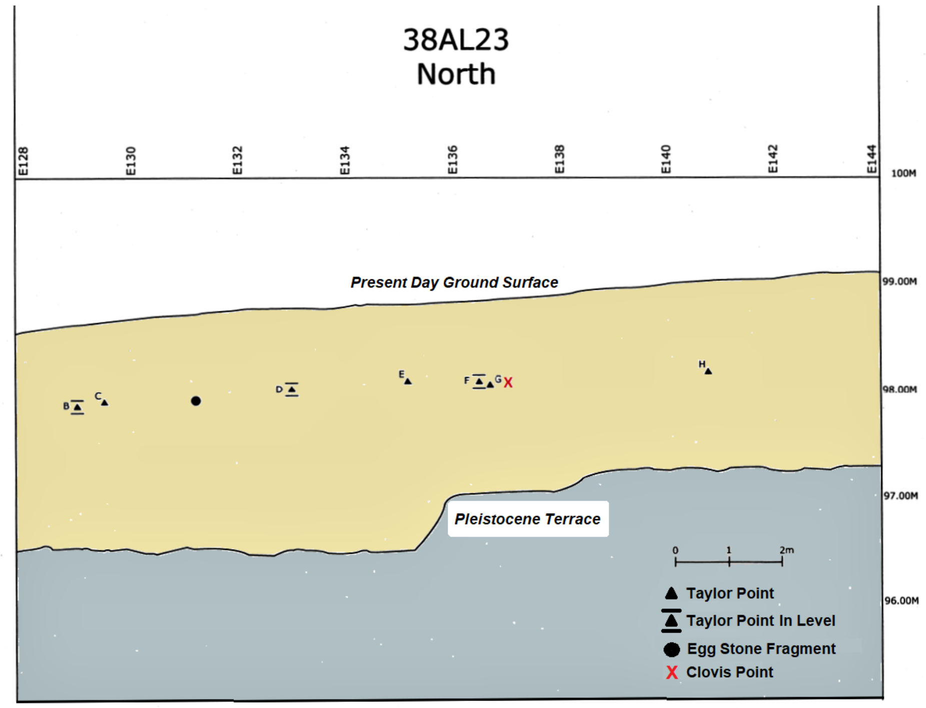


Figure 4: Back plot of Taylor points excavated in the terrace area of Topper showing existence of buried occupational surface following modern ground surface.

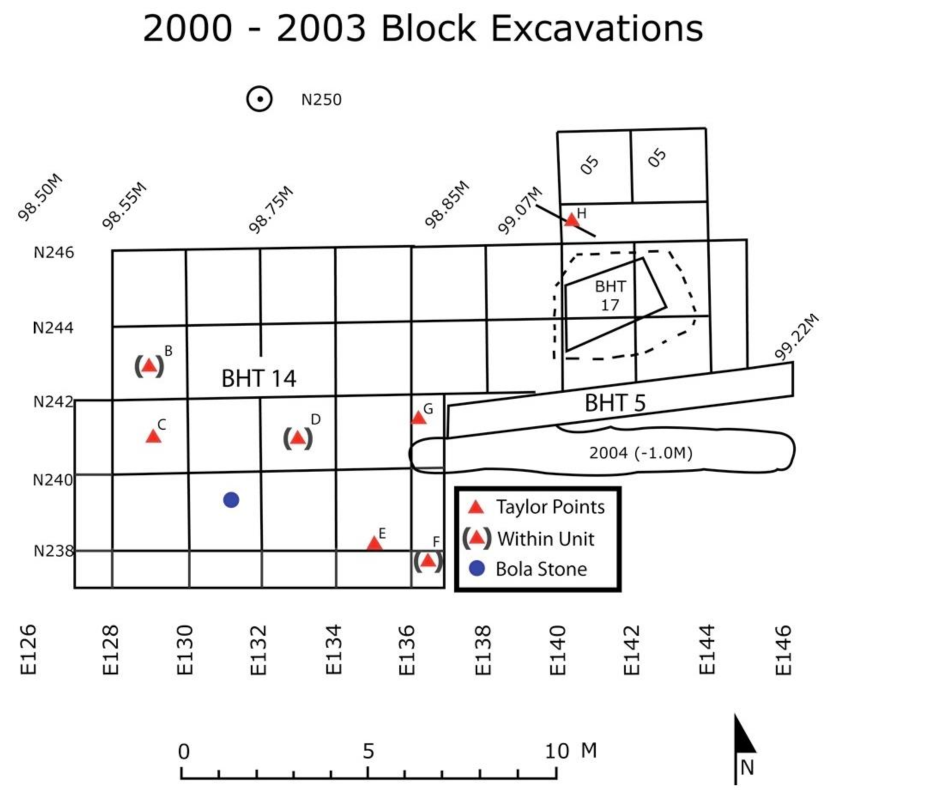


Figure 5: Plan map of locations of Topper site Taylor points excavated in the block on the terrace.

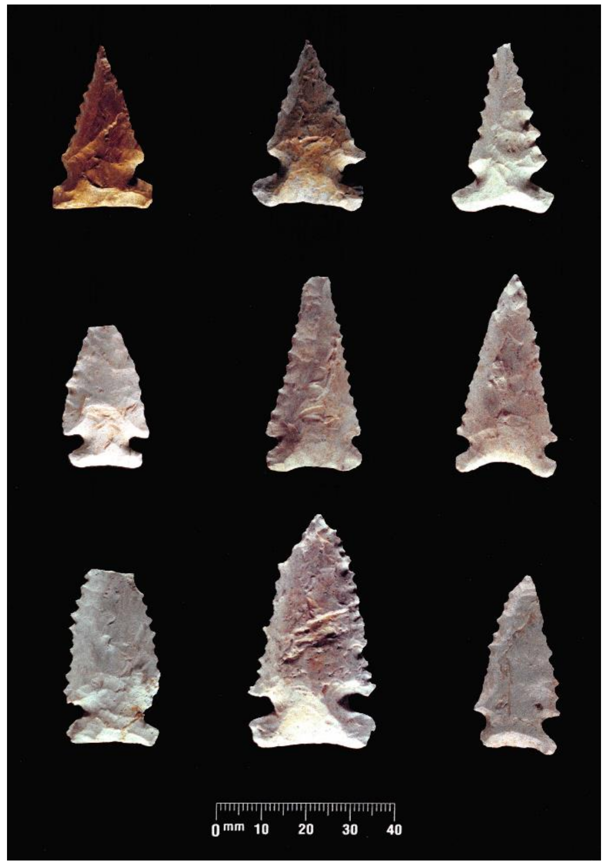


Figure 6: Examples of Taylor side notched points excavated throughout the terrace area of the Topper site.

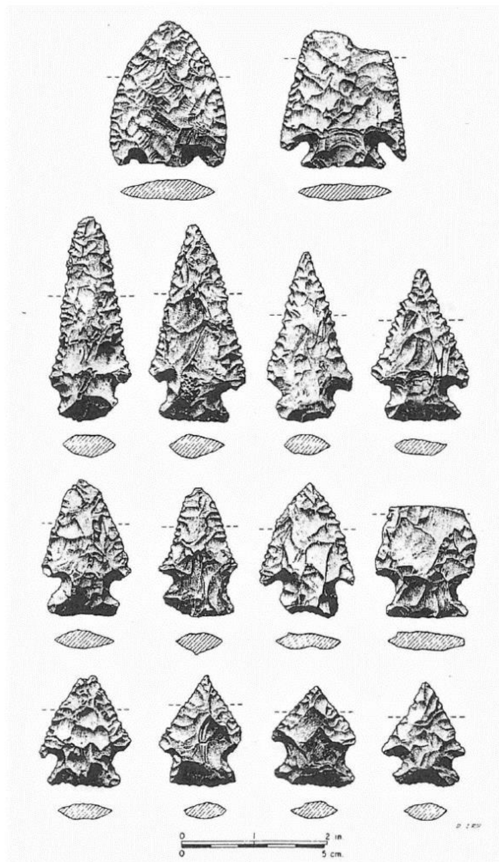


Figure 7: Whole and nearly whole Kirk Corner-Notched points excavated from the G.S. Lewis-East site (38AK228) block excavation. (From Sassaman, Daniel and Moore 2002:Fig. 3-2).

Table 1: Taylor Points from the Topper Site 2000-2003 Block Excavation Area.

Taylor Points from Topper Site 2000-2003 Block Area				
Artifact	**North**	**East**	**Depth**	**Note**
Point A	Backhoe Spoil	Backhoe Spoil	Backhoe Spoil	SW of Pavilion
Point B	N242	E128	70-80 cmbs	
Point C	N241.18	E129.51	97.89 M	
Point D	N240	E132	97.95-98.05 M	
Point E	N238.32	E135.17	98.07 M	Tip of Point
Point F	N236	E136	98.00-98.10 M NW Quad	Base of Point
Point G	N241.345	E136.70	98.05 M	
Point H	N247.58	E140.72	98.15 M	2005 Excavations
Eggstone Fragment	N239.67	E131.27	97.88 M	Magnetite Material

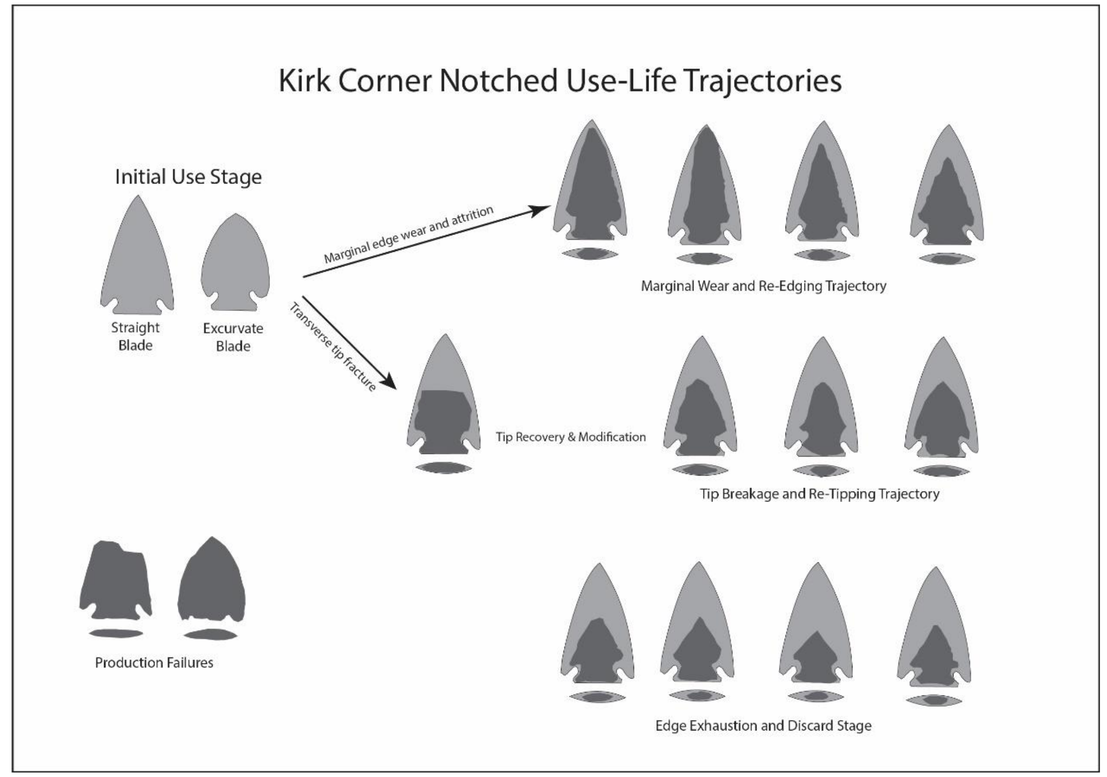


Figure 8: Graphic illustration of Kirk Corner Notch Use-Life Trajectories from the G.S. Lewis-East site (modified from Glen T. Hanson unpublished illustration).

Although not from a discrete pile or cluster, the typological similarity of the five points seems striking. It is difficult to think that somehow they were not deposited together in the manner of a cache, or perhaps were in a bag that got dropped in the river. The Cooper River is over 30 miles in length, and these were all found in one small area which underscores their mutual association.

Discussion and Conclusion

We know of four Early Archaic sites in South Carolina where a single point form – either side notched or corner notched – characterizes the assemblage. In the absence of a robust radiocarbon record and stratified sites in the region that clearly demonstrate the relationship between the point forms, this is the best positive evidence that we have for the non-contemporaneity of Early Archaic side and corner notched points. The existence of these sites is consistent with the side notched to corner notched sequence suggested by the record that exists across much of the East, and is consistent with the idea that side and corner notched points existed during some period of time as temporally separate point forms.

Depositional environments along major rivers near the Fall Line provide optimal locations to find deeply buried sites with closed artifact assemblages that allow vertical separation of components by time. Limited radiocarbon dating for two Georgia sites (Figure 1) has shown the typical Southeastern Kirk corner notched ^{14}C ages. At Rae's Creek (9RI327), a date of 9060 +/- 110 RCYRBP was obtained on an alluvially buried Kirk layer in what is described as a 10cm thick organic midden associated with a single Kirk corner notched point made from Coastal Plain chert (Crook 1990). Further west in Georgia, in the Lake Sinclair reservoir project at 9BL69, an alluvially buried "Early Archaic" stratigraphic unit 30 cm thick called Bolen/Palmer produced two Kirk age dates. Possible features produced dates of 9190 +/- 110 RCYRBP and 8690 +/- 50 RCYRBP (Espenshade et al. 1994:96). The five Early Archaic points from this unit are referred to as Palmer and Bolen and appear to be a mixture of side and corner notched,

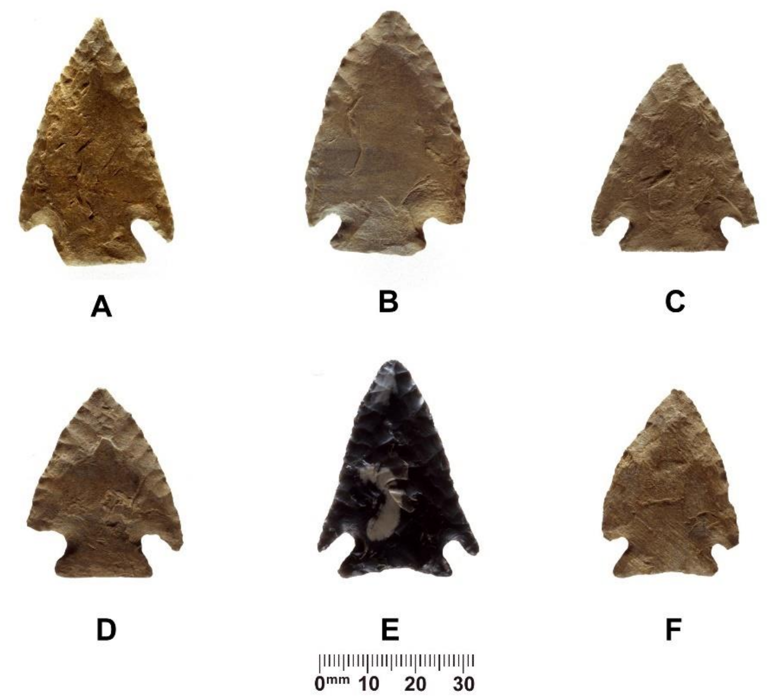


Figure 9: Kirk Corner-Notched points found in a cache from the Nipper Creek site, 38RI18 (From Goodyear et al. 2004:Figure 1).

Figure 10: Kirk Corner-Notched points found in a small area of the Cooper River, aka the Patterson "cache". (Photo courtesy of Tommy Charles.)

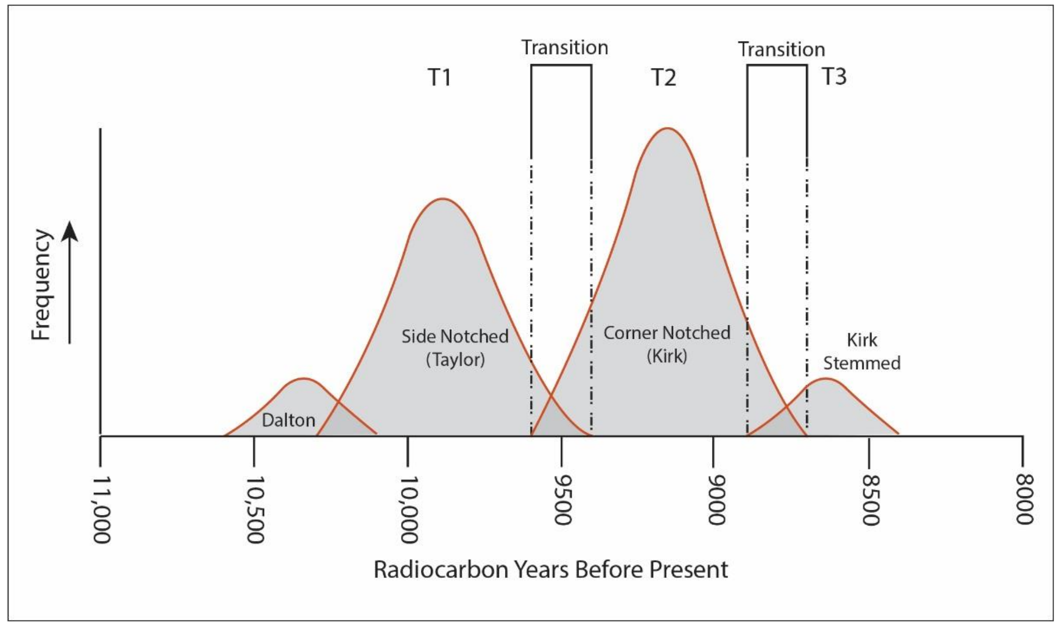


Figure 11: Graph of suggested temporal periods and transitions for early side-notched period (T1), through corner notched (T2), ending with Kirk stemmed (T3).

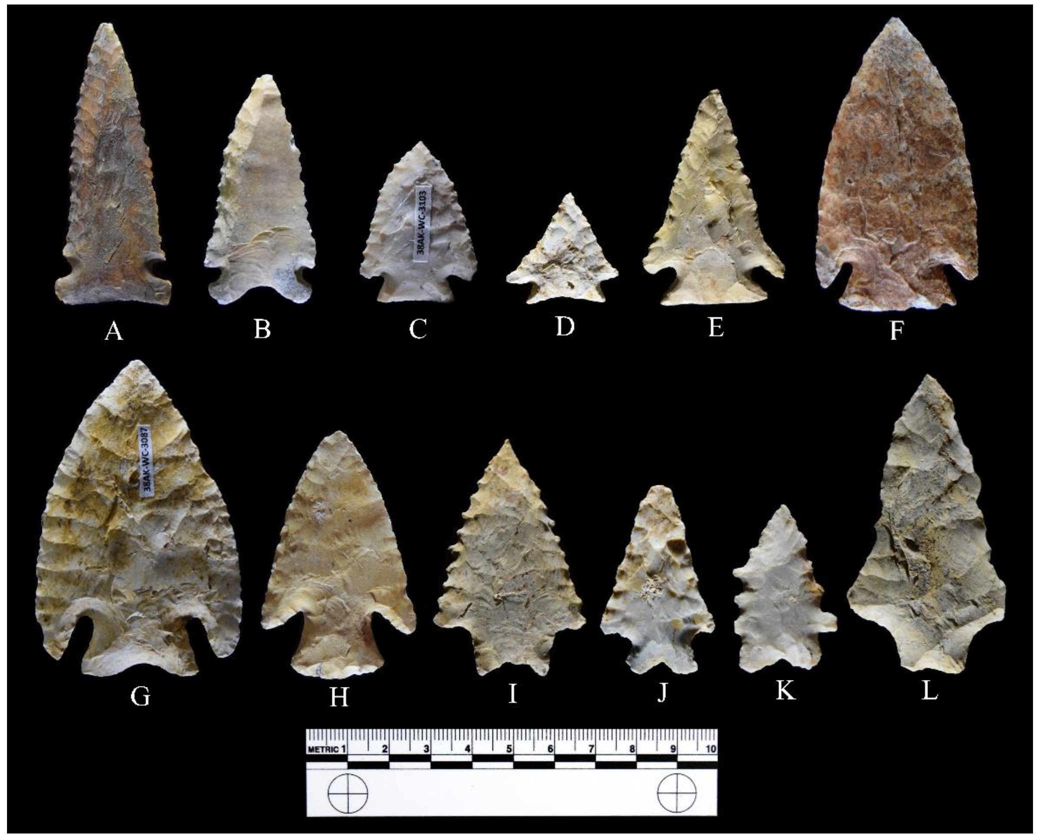


Figure 12: Examples of Early Archaic notched points from South Carolina showing typical typological forms. A) Taylor side notched, B) Van Lott side notched, C) Palmer corner notched, D) Decatur corner notched, E /F) Kirk corner notched, G) Lost Lake corner notched, H) Southern Hardin, I) Kirk Stemmed, J/K) Bifurcate LeCroy/MacCorkle, L) Stanly stemmed.

made on both quartz and chert (Espenshade et al. 1994:149).

There are multiple possible explanations for the co-occurrence of side and corner notched points. First, of course, corner notched and side notched points could have been made, used, and discarded by the same societies at the same time. This is the argument made based on the Florida data.

Second, depositional environments and various processes of disturbance may have acted to mix artifacts from sequential occupations over several centuries of reoccupation. Because of the generally stable climate during the Holocene, many landforms were repeatedly occupied through time. Where occupied surfaces received little or no sedimentation, vertical build up of sediment was not sufficient to separate the debris from successive occupations. Low rates of sedimentation coupled with biologically active topsoils would have led to a certain amount of conflating of temporally unrelated artifacts especially in the vertical dimension (Moore et al. 2018). Horizontal patterns may have been less affected. Both Topper and Lewis-East were formed by relatively simple occupational histories in such a way as to minimize the palimpsest effect. In this regard, stone tool caches such as Nipper Creek and probably Patterson would function as time capsules avoiding the confounding effect of mixing.

With regard to such depositional influences on the mixing of occupational residues, often an intense focus has been placed on the evaluation of stratigraphic relationships between notched types. This focus was derived from and has perhaps led to the investigation of denser sites where occupational residues have less clarity often as the result of the aforementioned circumstances (Glassow 1977). The assumption that the higher densities of artifacts represent relatively more significant sites has also influenced this focused approach. More recent archaeological works have sought to identify discrete occupational residues through horizontal spatial sampling, such that individual occupations can be identified in isolation, regardless of overall site density, without overlapping residues causing palimpsest concerns (Cable and Cantley 2002, 2005a, 2005b, 2006; Cantley and Cable 2002; Wilkinson et al. 2018). If Early Archaic studies are to continue to evaluate socio-cultural and technological changes throughout the period, isolated, discrete campsites need to be identified and sampled such that clear, short-time behavioral residues might be studied. Furthermore, isolating and evaluating discrete occupational and behavioral residues will provide contrasting data for comparison to larger, more dense assemblages that have previously been the focus of stratigraphic evaluations of Early Archaic chronologies.

Third, there are possible issues with how "side notching" and "corner notching" are defined. Complications in accurately typing an Early Archaic point can be considerable due to heavy blade resharpening and repairs of the haft element. The graphic produced by Glen Hanson (Figure 8) for the Lewis-East site is a plausible accommodation of this phenomenon. Also, there are inconsistencies among classifiers where, for example, small quartz side notched points have been called Palmers defaulting to their small size rather than noting their side notches (e.g., Goodyear et al. 1979:Figure 19). In a later study of quartz Early Archaic points, the distinction between side versus corner notched was observed (Goodyear 2014) resulting in significant differences between time periods.

In all, the evidence and logic suggest that there was a sequence from side notched to corner notched points during the Early Archaic period in South Carolina. Our positive evidence is the existence of closed assemblages that contain only one point form, both in South Carolina and elsewhere. There are several explanations for how debris from sequential human occupations can become mixed, producing the illusion of contemporaneity at sites where sedimentation during the early portion of the Early Archaic period was not sufficient to produce significant vertical separation between debris from sequential side notched and corner notched occupations. It is difficult to imagine, however, a post-depositional mechanism to explain how side and corner notched point types in use at the same time could be routinely separated into homogenous assemblages that show patterned stratigraphic relationships consistent with their different radiocarbon ages. We feel that there exists at this time no reason to reject the idea that a side to corner notched sequence occurred in this region along with most of the rest of the Eastern Woodlands.

Recognizing a side notched to corner notched sequence permits researchers to use these projectile point forms to study change through time during the Early Archaic. We envision side notched point forms such as Taylor as being ancestral to corner notched forms such as Kirk. If this is the case, there would have been a transition period where both side and corner notched points were present and/or where "transitional" points were produced that cannot be easily described as either Taylor or Kirk (Figure 11). The post-Kirk sequence likely includes forms such as Hardin (Figure 12) (Wilkinson 2017a, 2017b, 2018).

Proper assignment of an Early Archaic point to either the side notched (T1) or corner notched period (T2) is critical to being able to discern any significant change over the thousand or more years of Early Archaic life. Even now some interesting differences have been noted such as the greater numbers of corner notched points compared to side notched. Assuming both types existed for comparable spans of time, the greater number of corner notched points relative to side notched points suggests population growth. Patterns of raw material transport also seem to differ between side notched and corner notched points (Goodyear 2014; Wilkinson 2017a, 2018). There is a strong presence of Kirks made from lithic materials that are known to be from sources external to South Carolina including North Carolina Uwharrie Mountain rhyolites and Ridge and Valley type cherts known to occur in eastern Tennessee (Daniel 1996, 1998, 2001; Goodyear 2014; Sassaman 1996; Sassaman et al. 1988; Wilkinson 2017a, 2018). Population increase in Kirk times or not, a pattern of increased scales of mobility and/or widespread exchange among band and/or macroband members would portend significant cultural/behavioral changes associated with the advent of the Kirk Horizon in this region.

There are many holes to fill with respect to basic issues of Early Archaic projectile point chronology and technology. More datable sites with closed assemblages, as well as horizontally isolated short-time occupational residues, are needed to resolve chronological questions, and more detailed studies will be required to extract useful insights from the projectile points that remain (by necessity) one of our fundamental sources of information about Early Archaic societies.

References Cited

Ahler, Steven R., and Brad Koldehoff

2009 Dated Projectile Point Sequences from Modoc Rock Shelter and Application of Assemblage-Based Analysis. In *Archaic Societies: Diversity and Complexity Across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 199-227. State University of New York Press, Albany.

Anderson, David G. and Glen T. Hanson

1988 Early Archaic Settlement in the Southeastern United States: A Case Study from the Savannah River Valley. *American Antiquity* 53(2):262-286.

Anderson, David G. and Kenneth E. Sassaman

2004 Early and Middle Holocene Periods, 9500 to 3750 B.C. In *Handbook of North American Indians, Volume 14 Southeast*, edited by Raymond D. Fogelson, pp. 87-100. Smithsonian Institution, Washington.

2012 *Recent Developments in Southeastern Archaeology, from Colonization to Complexity*. Society for American Archaeology, The SAA Press.

Cable, John S. and Charles E. Cantley

2002 Prehistoric Site Structure and Settlement. In *Archaeological Data Recovery at Sites 38SU136/137 and 38SU141, Poinsett Electronic Combat Range, Sumter County, South Carolina*, edited by C.E. Cantley and J.S. Cable, pp. 235-342. Report prepared for U.S. Army Corps of Engineers, Savannah District. New South Associates, Stone Mountain, GA.

2005a *Phase II Archaeological Testing and Evaluation of Nine Prehistoric Sites in Cumberland and Hoke Counties, North Carolina*. Palmetto Research Institute Publications in Archaeology No. 8, Irmo, SC.

2005b A Methodological and Theoretical Approach to the Investigation of Hunter-Gatherer Settlement Systems: A Case Study from Fort Bragg, North Carolina. Paper presented at the Southeastern Archaeological Society Conference. Columbia, SC.

2006 *Phase II Archaeological Testing and Evaluation of Six Prehistoric Sites in Hoke County, Fort Bragg, NC*. Final Report submitted to the National Park Service and the Department of the Army by Palmetto Research Institute, Irmo, SC.

Cantley, Charles, and John Cable
2002 *Archaeological Data Recovery at Sites 38SU136/137 and 38SU141, Poinsett Electronic Combat Range, Sumter County, South Carolina*. Report prepared for U.S. Army Corps of Engineers, Savannah District. New South Associates, Stone Mountain, GA.

Chapman, Jefferson
1973 *The Icehouse Bottom Site (40MR23).* Reports of Investigations No. 13. Department of Anthropology, University of Tennessee, Knoxville.
1976 The Archaic Period in the Lower Little Tennessee River Valley: The Radiocarbon Dates. *Tennessee Anthropologist* 1(1):1-12.
1985 Archaeology and the Archaic Period in the Southern Ridge-and-Valley Province. In *Structure and Process in Southeastern Archaeology*, edited by Roy S. Dickens, Jr., and H. Trawick Ward, pp. 137-153. The University of Alabama Press, Tuscaloosa.

Charles, Tommy and Christopher R. Moore
2018 *Prehistoric Chipped Stone Tools of South Carolina*. Piedmont Archaeological Studies Trust: P.A.S.T, Glendale, South Carolina.

Coe, Joffre L.
1964 *The Formative Cultures of the Carolina Piedmont*. Transactions of the American Philosophical Society 54(5). Philadelphia.

Crook, Morgan R., Jr.
1990 *Rae's Creek: A Multicomponent Site at the Fall Line Along the Savannah River.* Department of Anthropology, Georgia State University, Atlanta.

Daniel, I. Randolph, Jr.
1996 Raw Material Availability and Early Archaic Settlement in the Southeast. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 84-91. University of Alabama Press, Tuscaloosa.
1998 *Hardaway Revisited, Early Archaic Settlement in the Southeast*. University of Alabama Press, Tuscaloosa.
2001 Stone Raw Material Availability and Early Archaic Settlement in the Southeastern United States. *American Antiquity* 66(2):237-265.

Driskell, Boyce
1996 Stratified Late Pleistocene and Early Holocene Deposits at Dust Cave, North west Alabama. In: *The Paleoindian and Early Archaic Southeast,* David Anderson and Kenneth Sassaman (eds.), University of Alabama Press, Tuscaloosa pp. 315-330.

Espenshade, Christopher T., John E. Foss, and Linda Kennedy
1994 *Furman Shoals in Prehistory: Archaeological Data Recovery at Site 9BL69, Lake Sinclair Project, Baldwin County, Georgia*. Brockington and Associates, Inc., Atlanta.

Faught, Michael K., Michael Hornum, Brinnen Carter, R. Christopher Goodwin, and S. David Webb
2003 Earliest Holocene Tool Assemblages from Northern Florida with Stratigraphically Controlled Radiocarbon Estimates (Sites 8LE2105 and 8JE591). *Current Research in the Pleistocene* 20:16-18.

Glassow, Michael A.
1977 Issues in Evaluating the Significance of Archaeological Resources. *American Antiquity* 42(3):413-420.

Goodwin, R. Christopher, William P. Barse, Charlotte D. Pevny, Brian Ostahowski, Sherman W. Horn III, David Chatelain, Jon Bryan, David K. Thulman, John Fagan, Timothy E. Riley, Sarah E. Price, and Tara L. Potts
2013 *Adapting to Climate Change at the Pleistocene - Holocene Transition: Data Recovery of Five Late Paleoindian to Early Archaic Sties along Florida's Cody Scarp (8LE2105, 8LE2102, 8JE880/LE1549, 8JE872, and 8JE878)*. Submitted to the Florida Gas and Transmission Company, Houston, Texas, by R. Christopher Goodwin and Associates, Inc., Frederick Maryland and New Orleans Louisiana, FMSF Survey No. 20082.

Goodyear, Albert C.
2014 Paleoindian in COWASEE: Time, Typology, and Raw Material Selection. *South Carolina Antiquities* 46:3-20.

Goodyear, Albert C., John H. House, and Neal W. Ackerly
1979 *Laurens-Anderson: An Archeological Study of the Inter-Riverine Piedmont*. Anthropological Studies 4. Occasional Papers of the Institute of Archeology and Anthropology, The University of South Carolina.

Goodyear, Albert C. and Tommy Charles
1984 An *Archeological Survey of Chert Quarries in Western Allendale County, South Carolina*. Research Manuscript Series 195. Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Goodyear, Albert C., William Radisch, Ruth Wetmore, and V. Ann Tippitt.
2004 *A Kirk Corner-Notched Point Cache from the Nipper Creek Site (38RD18), South Carolina*. Current Research in the Pleistocene 21:42-4

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Indiana University Press, Bloomington.

Kimball, Larry R.
1996 Early Archaic Settlement and Technology: Lessons from Tellico. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E Sassaman, pp.149-186. The University of Alabama Press, Tuscaloosa.

Michie, James L.
1966 The Taylor Point. *The Chesopiean* 4(5-6):123-124.

Moore, Christopher R., Mark J. Brooks, I. Randolph Daniel Jr., Andrew H. Ivester, James K. Feathers, and Terry Barbour
2018 Regional Manifestations of Late Quaternary Climate Change and Archaeological Site Burial along the South Atlantic Coastal Plain. In *Early Human Life on the Southeastern Coastal Plain*, edited by Albert C. Goodyear and Christopher R. Moore, pp. 193-235. University Press of Florida.

Morrow, Toby A.
1996 Lithic Refitting and Archaeological Site Formation: A Case Study from the Twin Ditch Site, Greene County, Illinois. In Stone *Tools: Theoretical Insights into Human Prehistory*, edited by George H. Odell, pp. 345-373. Plenum Press, New York.

Pevny, Charlotte Donald, David K. Thulman, and Michael K. Faught
2018 Ancestor- Descendant Relationships in the Early Holocene: Evidence for Clovis Paleoindian–Bolen Early Archaic Cultural Continuity in Florida. In *In the Eastern Fluted Point Tradition Volume II*, edited by J. A. M. Gingerich, pp. 213-239. University of Utah Press, Salt Lake City.

Sassaman, Kenneth E.
1996 Early Archaic Settlement in the South Carolina Coastal Plain. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 58-83. University of Alabama Press, Tuscaloosa.

Sassaman, Kenneth E., Glen T. Hanson, and Tommy Charles
1988 Raw Material Procurement and the Reduction of Hunter-Gatherer Range in the Savannah River Valley. *Southeastern Archaeology* 7:79-94.

Sassaman, Kenneth E., I. Randolph Daniel Jr., and Christopher R. Moore
2002 *G.S. Lewis-East, Early and Late Archaic Occupations along the Savannah River, Aiken County, South Carolina*. Savannah River Archaeological Research Papers 12, Occasional Papers of the Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina.

Sherwood, Sarah C., Boyce Driskell, Asa R. Randall, and Scott Meeks
2004 Chronology and Stratigraphy at Dust Cave, Alabama. *American Antiquity* 69:533-554.

Smith, Edward E., Jr.
1995 The Swan's Landing Site (12HR304): An Early Archaic (Kirk Horizon) Site in Harrison County, South-Central Indiana. *Midcontinental Journal of Archaeology* 20(2):192-238.

Stafford, C. Russell, and Mark Cantin
2009 Archaic Period Chronology in the Hill Country of Southern Indiana. In *Archaic Societies: Diversity and Complexity Across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 287-313. State University of New York Press, Albany.

Tuck, James A.

1974 Early Archaic Horizons in Eastern North America. *Archaeology of Eastern North America* 2(1):72-80.

Wetmore, Ruth Y. and Albert C. Goodyear
1986 *Archaeological Investigations at Nipper Creek, 38RD18: An Archaic Fall Line Site*. Research Manuscript Series 201. Institute of Archaeology and Anthropology, University of South Carolina, University of South Carolina, Columbia.

White, Andrew A.
2016 A Preliminary Analysis of Haft Variability in South Carolina Kirk Points. *South Carolina Antiquities* 48:41-53.
2019 A Comparison of Functional Variability Among Early Archaic Notched Points from the Lower Savannah River. *South Carolina Antiquities* 51:1-22.

Wilkinson, Joseph E.
2017a Modeling Early Archaic Mobility and Subsistence: Evaluating Resource Risk across the South Carolina Landscape. Unpublished Masters thesis, Department of Anthropology, The University of South Carolina.
2017b The Southern Hardin in South Carolina. *South Carolina Antiquities* 49:1-23.
2018 From the Savannah to the Santee River: Early Archaic Mobility and Raw Material Utilization on the Coastal Plain of South Carolina. In *Early Human Life on the Southeastern Coastal Plain*, edited by Albert C. Goodyear and Christopher R. Moore, pp. 274-298. University Press of Florida.

Wilkinson, Joseph E., Audrey R. Dawson, David E. Rigtrup, and Alaina Williams McDaniel
2018 Data Recovery at Two Sites: Micro-Interval Shovel Testing, Excavation Units, and Geomorphology of Sites 38RD843 and 38RD837/841/842/844, U.S. Army Garrison, Fort Jackson, South Carolina. Report prepared for U.S. Army, Fort Jackson. Applied Research Division, South Carolina Institute of Archaeology and Anthropology, University of South Carolina.

About the Contributors

Mark J. Brooks conducts geoarchaeological research in the southeastern U.S. Coastal Plain, focusing on integrated studies of climate and landscape change, archaeological site formation, and early hunter-gatherer adaptations. He retired from SRARP-SCIAA, USC in 2014 but continues to pursue his research interests.

Katie Stringer Clary, Ph.D. is an assistant professor of history, public history at Coastal Carolina University in Conway, South Carolina. Her work on accessibility and programs for museums and historic sites culminated in the book, *Programming for People with Special Needs* (2014). She is continuing that work, using 3D technologies and hopes to partner with more community organizations to help them become more accessible to all visitors. She is currently working on new research on human remains in museums, and Clary teaches courses in public history, museum studies, ancient history, and cultural heritage courses at CCU.

Bob Costello earned his PhD in Biochemistry from Stanford University in 1970. Since 1980 he has served on the faculty of USC Sumter, where he currently holds the rank of Professor of Chemistry. Since 2008, he has been involved in collaborative research in archaeology with Kenn Steffy, which has resulted in several presentations and publications. He received the 2011 ASSC Article of the Year Award for his *South Carolina Antiquities* article *Macroscopic Analysis of an Allendale Chert Flake Tool Assemblage from Northeastern Lake Marion*.

Carolyn Dillian is Professor and Chair of the Department of Anthropology and Geography at Coastal Carolina University, in Conway, South Carolina. Her expertise is in prehistoric archaeology and laboratory methods, including ongoing field investigations on shell middens along the northern South Carolina coast and geochemical characterization studies of archaeological artifacts using pXRF. Dillian teaches classes on archaeological method and theory, North American prehistory, and Cultural Resource Management.

Albert C. Goodyear is a retired archaeologist affiliated with the SC Institute of Archaeology and Anthropology at the University of South Carolina. He is the Director of the Southeastern Paleoamerican Survey and the project director of the Topper site excavations.

Quinn-Monique Ogden is an archaeologist at S&ME Inc. in the Charleston, South Carolina Office. She worked as a field director and field technician all over the country on Phase I and Phase II archaeological surveys, Data Recovery projects, and cemetery relocations. She has also worked on excavations on St. Catherine’s Island, with the American Museum of Natural History. In addition to her archaeological experience, her forensic experience includes participation in large-scale search and recovery effort for human remains and personal effects within soils removed from the World Trade Center Site and a plane crash in Laos from the Vietnam War.

Carl Steen is a native of the South Carolina Lowcountry. He received a Bachelors Degree in Anthropology at the University of South Carolina and a Master’s Degree in Anthropology at the College of William and Mary. He is president of the Diachronic Research Foundation, a non-profit corporation dedicated to research and historic preservation.

Andrew A. White is a Research Assistant Professor at the University of South Carolina, with the South Carolina Institute of Archaeology and Anthropology. He is an anthropological archaeologist interested understanding long term, large scale social change in hunter-gatherer societies, particularly during the

Archaic period of eastern North America. His work combines traditional archaeological fieldwork with complex systems theory and collections-based research.

Joseph E. Wilkinson received his Bachelors and Masters degrees in Anthropology from the University of South Carolina. He currently serves as the Archaeological Society of South Carolina's Journal Editor. His research focuses on the Early Archaic cultural period, research that benefits from continued work with private collections across South Carolina and the broader Southeast.

Proof