

ANALYSIS OF A PALEOINDIAN STONE TOOL ASSEMBLAGE FROM THE PASQUOTANK SITE (31PK1) IN NORTHEASTERN NORTH CAROLINA

I. Randolph Daniel, Jr., William H. Moore,
and James Pritchard

The Pasquotank site (31PK1) is a shallow, multicomponent site located in the vicinity of the Dismal Swamp along the Pasquotank River in northeast North Carolina. Intermittent surface collecting over several decades has yielded three fluted points and over 100 chipped stone artifacts that are attributable to a Paleoindian occupation. The artifact assemblage is dominated by nonlocal stone whose source might be located along the Fall Line of Virginia near the Nottoway River. Three design characteristics of the assemblage that provide insight into prehistoric foraging adaptations stand out: high-quality tool-stone, tool curation, and tool recycling. The Pasquotank assemblage appears unique in North Carolina and represents one of the few known Paleoindian assemblages in the Southeast.

Most of the Paleoindian archaeological record in the Southeast is known from typological studies in the form of statewide fluted-point surveys. Sites with sufficient stratigraphic depth or integrity to document fluted-point assemblages are exceedingly rare (Goodyear 1999). The Pasquotank site reported here is an exception to this pattern because it represents a shallow, virtually single component fluted-point site with a recognizable Paleoindian component. To the best of our knowledge the Pasquotank assemblage is unique in North Carolina and one of the few known fluted-point assemblages in the Southeast.

Here we document the discovery of the site and describe the artifact assemblage. Our analysis also considers the broader implications the assemblage has for Paleoindian technological organization, settlement mobility, and site function in the Southeast. We also address theoretical issues with regard to forager technological organization.

Background

The Pasquotank site is located in the vicinity of the Great Dismal Swamp on the south side of the Pasquotank River, 6.5 km northwest of Elizabeth City, North Carolina (Figure 1). The site is situated near the head of a ravine along the western edge of a large flat

terrace that overlooks the river, which is less than 500 m to the north. James Pritchard of Suffolk, Virginia, discovered the site based on the surface collection of a few dozen stone tools—including fluted points—in a cultivated field on his family farm during the early 1960s (Traver 1964:15).

The collection was subsequently reported by Traver (1964) and three fluted points from the site were described by Perkinson (1971:10–13) in his North Carolina fluted-point survey. At that time the points were described as coming from “an essentially “pure” surface Paleo site... in a cultivated field near the Pasquotank River” (Perkinson 1971:10). Meanwhile, Pritchard continued to collect the site, although nothing further appeared in the literature regarding its potential significance until now. Pritchard surface collected adjacent fields covering about 21 ha, although he focused his collecting on an area covering about 7 ha from which the majority of artifacts were recovered. Virtually all the known artifacts from the Pasquotank site are in Pritchard’s personal collection. The site came to the senior author’s attention a few years ago through a graduate student whose analysis of the assemblage forms the basis of this paper (Moore 2002).

Although no claim can be made with respect to a systematic collection strategy, we nevertheless believe the assemblage is representative of the archaeological remains at the site for several reasons. First, Pritchard has collected the site intermittently since its discovery in the 1960s, attempting to recover any object perceived to be an artifact including both tools and flakes. Repeatedly examining the cultivated field for some five decades has allowed Pritchard ample opportunity to surface collect under conditions of high surface visibility. Moreover, the lengthy duration of his collecting has significantly increased the assemblage total from the few dozen artifacts reported in the early 1960s (Traver 1964) to the nearly 500 specimens collected to date.

Second, the diversity of stone raw materials and artifact types (including points, other chipped-stone tools, and flaking debris) suggests Pritchard succeeded in making an unbiased attempt on his part to collect any potential stone artifact regardless of class or raw material type. Likewise, the extremely small size of some flakes (see below) also suggests that Pritchard made a serious attempt at recovering artifacts regardless of size. In this regard, the relative absence of natural stone in the field increased the likelihood of Pritchard seeing and collecting stone artifacts. One

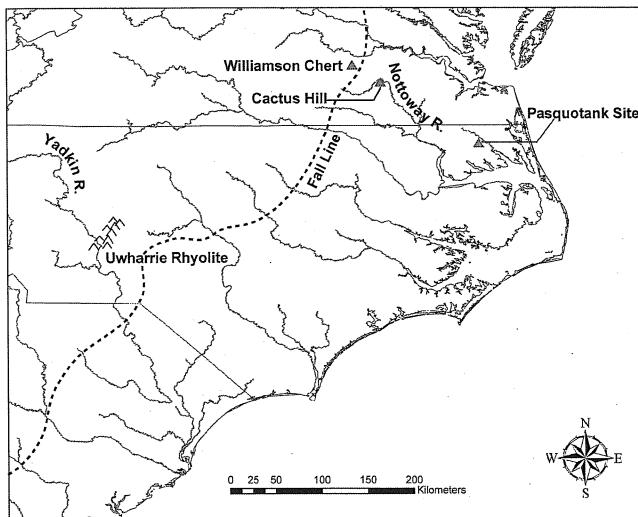


Figure 1. Location of Pasquotank site and potential tool stone sources.

exception to this rule would be with regard to quartz or quartzite debitage, which he admits to being less concerned about collecting. Thus the most apparent bias in the assemblage would be the under representation of quartz or quartzite flaking debris, particularly given the abundance of collected Archaic and Woodland points manufactured from these materials (see below). Likewise, quartz and quartzite debitage (and perhaps tools) are likely under represented in the Paleoindian component as well. Nevertheless, if the relatively minor presence of these materials in the flaked-tool portion of the Paleoindian assemblage is any indication, then these materials would have constituted only a minor portion of the raw materials in the Paleoindian debitage as well. One bias does exist with respect to the absence of ceramics in the assemblage; however, this does not affect the analysis of the Paleoindian assemblage. Pritchard did not collect pottery, although he did observe some sherds during his collecting efforts; however, pottery was a rare occurrence in the fields and the sherds so small as to be relatively undiagnostic.

In sum, based on the prolonged collecting time, the wide range of recovered artifact classes, their sizes, and stone types, we cautiously suggest that the Pasquotank assemblage represents a reasonably unbiased sample of the stone artifacts at the site.

Stone Types

Raw material types in the Pasquotank assemblage were determined through macroscopic analysis (see Moore 2002). Initially, artifacts were classified according to conventionally recognized archaeological stone types. These included five broad categories: metavolcanic stone, chert, jasper, quartz, and quartzite. Second,

some materials within each category were sorted into subclasses according to stone color and texture and, in the case of metavolcanic stone, the presence/absence of features such as flowbanding and phenocrysts (Tables 1–2). Finally, potential stone sources were identified based on macroscopic comparisons with samples from the stone type collection at the Phelps Archaeology Laboratory at East Carolina University. Metavolcanic stone dominates the assemblage, constituting over three-quarters of both the tool and debitage classes. This category appears to include a rhyolitic tuff and a series of rhyolitic flows. Rhyolite is a fine-grained meta-igneous rock composed mainly of quartz and feldspar and exhibits a good to excellent conchoidal fracture (Daniel and Butler 1996:21–22).

What we are classifying as a rhyolitic tuff is a high-quality, fine-grained green siliceous stone. In fact, some specimens appear so siliceous that the stone looks like a green chert. White patches also occur in varying amounts on this material. In most cases these patches appear to be artifact weathering, but in other instances they could represent cortex remnants. Small pyrite inclusions are sparsely disseminated in a few artifacts. Rhyolitic flows in the assemblage include both aphyric and porphyritic rhyolites. Aphyric rhyolite in the Pasquotank assemblage is a high-quality, dark gray rhyolite. Two varieties of a porphyritic rhyolite—each represented by a single tool—are present in the assemblage. Type I Porphyritic rhyolite is characterized by the presence of sparse plagioclase phenocrysts disseminated in a fine- to medium-grained aphanitic gray groundmass. Type II Porphyritic rhyolite is characterized by the presence of moderate amounts of quartz phenocrysts disseminated in highly weathered gray groundmass.

It is difficult to confidently identify the sources of the metavolcanic stone in the Pasquotank assemblage. Presumably, these stone types did not originate near the site (Figure 1). With regards to the rhyolitic tuff, it is possible, but by no means certain that it originated from the Bolster's Store quarry (McAvoy 1992:26–28) located a few kilometers south of the famous Williamson chert source (Byers 1954) along the Fall Line in Virginia. At Bolster's Store, material was mined from the banks of Hardwood Creek, a tributary of the Nottoway River. Chemical analyses have documented the presence of both metavolcanic stone and chert at Bolster's Store. Although the green tool-stone stone is apparently of metavolcanic origin, it is described as being "chert-like" in quality (McAvoy 1992:26). This is an apt description of the material in the Pasquotank assemblage. In addition to matching the Bolster's Store material in color and texture, the Pasquotank stone also occasionally exhibits small pyrite in its groundmass. Pyrite is a distinctive feature of the Bolster's Store material, although it doesn't appear to occur in the

Table 1. Frequency Distribution of Chipped Stone Raw Material by Artifact Class.

Raw Material	Fluted Points	Other Bifaces	Pièces Esquillées	End Scrapers	Side Scrapers	Pointed Scrapers	Limaces	Flake Gravers	Uniface Fragments	Total	%
Rhyolitic tuff	1	4	1	41	6	1	7	5	12	78	70.3
Aphyric rhyolite	0	0	0	4	0	0	2	0	0	6	5.4
Quartz porphyritic rhyolite	0	0	0	0	0	0	1	0	0	1	0.9
Type I porphyritic rhyolite	0	0	0	0	1	0	0	0	0	1	0.9
Type II porphyritic rhyolite											
Chert											
Type I chert	0	2	0	3	1	0	0	1	0	7	6.3
Type II chert	0	0	0	0	0	0	0	1	0	1	0.9
Type III chert	0	0	0	1	0	0	0	0	0	1	0.9
Type IV chert	0	0	0	1	0	0	0	0	0	1	0.9
Type V chert	0	0	0	0	1	0	0	0	0	1	0.9
Type VI chert	0	0	0	1	0	0	0	0	0	1	0.9
Jasper											
Type I jasper	0	0	0	4	1	0	1	0	0	6	5.4
Type II jasper	0	1	0	1	0	0	0	0	0	2	1.8
Type III jasper	1	0	0	1	0	0	0	0	0	2	1.8
Quartz	1	0	0	1	0	0	0	0	0	2	1.8
Quartzite	0	0	0	1	0	0	0	0	0	1	0.9
Total	3	7	1	59	10	1	11	7	12	111	100

Note: For purposes of this table, *Limace* frequencies include two specimens (Type I rhyolitic tuff) recycled as hafted spokeshaves and one specimen (Type I jasper) recycled as a graver. Also, for purposes of this table, two refitted *Limace* fragments and two refitted end scraper fragments are counted as one specimen each.

Pasquotank artifacts in the abundance that is described by McAvoy (1992:26-27). In any case, if the Bolster's Store quarry is the source for the Pasquotank material, it would lie about 140 km northwest of the site. Otherwise, the nearest geologic formation containing metavolcanic rocks is the Eastern Slate Belt located along the Fall Line, also about 140 km west of the Pasquotank site or the Carolina Slate Belt slightly farther west.

Turning to the other metavolcanic stone in the assemblage, it is possible at least some stone originated from the Carolina Slate Belt in the central Piedmont. Presently, the best known source of various metavolcanic stone types in North Carolina is the Uwharrie Mountains along the Yadkin River some 360 km west of Pasquotank (Daniel and Butler 1996; Steponaitis et al. 2006). Among the metavolcanic stone types identified in the assemblage, the aphyric rhyolite most closely resembles a knappable stone from Morrow Mountain (Daniel and Butler 1996:10-15), a known quarry in the southern Uwharrie Mountains. Moreover, the two porphyritic rhyolite artifacts somewhat resemble material from known quarries in the southern Uwharrie Mountains (Daniel and Bulter 1996; Steponaitis et al. 2006). If they did not originate from some location in the Uwharries, they could have come from somewhere else in the Carolina Slate Belt or the Eastern Slate Belt. Of course, it is possible that the metavolcanic stone was acquired from a closer, secondary cobble source along a Coastal Plain river, but the absence of cobble cortex on any aphyric or porphyritic specimens precludes this determination.

Chert represents cryptocrystalline stone in the assemblage identified by its siliceous and often "waxy" appearance. As sorted here by color and texture, several varieties of chert are present in the assemblage. In fact, other than their siliceous appearance, the chert specimens in the assemblage are quite variable in terms of color and texture. Nevertheless, several specimens grouped as Type I chert exhibit a medium- to fine-grained texture and a heavily variegated light brown-tan-cream color that appear to match chert from the previously mentioned Bolster's Store quarry. Isolated examples of five other chert types are present including a medium-grained, dark yellowish brown chert (Type II Chert), a fine-grained dark olive-brown chert mottled with reddish brown inclusions and with a waxy texture (Type III Chert), fine-grained light tan chert containing a remnant of a thick, compact, white cortex (Type IV Chert), a waxy, fine-grained whitish gray chert (Type V Chert), and an opaque, dull-black, fine-grained chert (Type VI Chert).

Assuming that most of the above cherts were not acquired from secondary cobble sources, then the nearest known chert quarries also lie in the vicinity of Bolster's Store (McAvoy 1992:24-33). Several chert

Table 2. Frequency Distribution of Flake Raw Material by Flake Size.

Stone Type	Size 1 (<6 mm)	Size 2 (6–12.7 mm)	Size 3 (12.7–25.4 mm)	Size 4 (>25.4 mm)	Total	%
Rhyolitic tuff	27	120	42	5	194	70.8
Aphyric rhyolite	5	12	5	1	23	8.4
Other metavolcanic stone	13	14	12	3	42	15.0
Type I chert	0	2	4	0	6	2.2
Jasper	0	0	1	0	1	0.5
Other chert	0	0	1	0	1	0.5
Quartz	0	4	2	1	7	2.6
Total	45	152	67	10	274	100

sources lie within a few kilometers of each other and include the Williamson site along Little Cattail Creek and the Mitchell and Bolster's Store quarries along Hardwood Creek to the south. And while few, if any, of the Pasquotank specimens appear to match the classic variegated cream-blue-gray colors for which Williamson chert is best known, many of the other chert types are not beyond the range of variation described for Williamson stone (McAvoy 1992:25). Thus, despite the variety of cherts described here, they all may have originated from a limited number of source locations.

Several fine-grained specimens were labeled as jasper based upon their waxy yellowish brown to reddish brown color. In fact, the reddish color on two artifacts strongly suggests this material may be heat treated. Again, we can only speculate about the source(s) of this material. But given that jasper or jasper-like stone has been reported from the Williamson and Mitchell quarries noted above, we suggest the Virginia Fall Line as the likely source of the jasper in the Pasquotank assemblage. Three artifacts might be an exception, however. The retention of some cobble cortex on these artifacts suggests the use of a secondary river source. Jasper pebbles, in fact, were collected from old river channels along the coast by prehistoric groups during the Late Woodland (Phelps 1983:22). Presumably, this practice could have begun even earlier.

The categories "other metavolcanic stone" and "other chert" are residual types used for the flaking debris (Table 2) that includes a variety of metavolcanic stone types and a single chert type not recognized in the Paleoindian tool assemblage. Some of this flaking debris is likely associated with either the Archaic or Woodland components at the site. Quartz and quartzite represent the final raw material classes in the assemblage and include a clear crystalline quartz and a sugarlike medium- to large-grained textured quartzite. These latter two materials are minor parts of the assemblage and could have come from most anywhere in the Coastal Plain or beyond.

In sum, virtually all of the tool-stone in the assemblage, except perhaps the quartz and quartzite, are considered to be nonlocal to the Pasquotank site. Indeed, the Pasquotank site does not appear to be located anywhere near a tool-stone source. Unconsolidated Quaternary

deposits constitute the majority of the North Carolina Coastal Plain, limiting access to underlying solid rock formations and generally creating a stone deprived environment (Pilkey et al. 1998). Thus, despite the apparent diversity of raw materials in the assemblage, we propose that the vast majority of the Pasquotank tool-stone probably came from a relatively limited area of the Fall Line. Almost certainly, the rhyolitic tuff probably came from a single source. Of course, this interpretation as well as all the proposed source locations should be regarded as propositions for further testing.

Nevertheless, the predominant use of nonlocal tool-stone in the Pasquotank assemblage is not unusual for a Paleoindian assemblage. Indeed, it represents a pattern of tool-stone use typical of fluted-point assemblages virtually anywhere in North America (e.g., Goodyear 1989; Haynes 2002:92; Meltzer 1993:304–305). We return to this pattern below when we discuss the implications that the Pasquotank stone sources have for settlement mobility.

The Assemblage

The context of the Pasquotank site strongly resembles the shallow, plowzone-like context of fluted-point sites in the Northeast like Debert (MacDonald 1968) or Vail (Gramly 1982). Although the Pasquotank assemblage is a surface collection that represents multiple components, there is a remarkable clarity in the assemblage with respect to the Paleoindian occupation. We say this for two reasons. First, the morphologies of the recovered bifaces and unifaces are distinctive. In addition to the fluted points, the unifacial tools exhibit forms that are readily classifiable as Paleoindian in character including end scrapers, side scrapers, *limaces*, and graters (see, e.g., Gramly 1982; MacDonald 1968). Second, a single high-quality stone type appears to dominate both the tool assemblage and the stone debitage—a continent-wide pattern for Paleoindian assemblages (see Goodyear 1989; Meltzer 1988:26–28). This metavolcanic stone can be observed in every tool class, including fluted points, providing some evidence that temporally links the fluted points with much of the other stone artifacts in the assemblage.

Table 3. Archaic and Woodland Point Frequencies by Stone Type from the Pasquotank Site.

Point Types	Quartzite	Metavolcanic	Chert	Quartz	Total
Archaic					
Hardaway	0	1	0	0	1
Side-Notched					
Palmer	2	0	0	0	2
Kirk Corner-Notched	2	0	0	0	2
Stanly Stemmed	5	0	2	0	7
Morrow	23	15	7	6	51
Mountain					
Savannah River	4	1	0	1	6
Small Savannah River	4	0	0	1	5
Woodland					
Swansborro	5	1	1	1	8
Yadkin	0	0	1	0	1
Small triangular	5	1	1	1	8
Indeterminate					
	4	6	1	0	11
Total	54	25	13	10	102

Of course, the recovery of Archaic and Woodland points at the site does indicate the site was repeatedly visited by later period groups (Table 3). Thus, while we cannot conclusively demonstrate the assemblage described below is exclusively Paleoindian, we submit that few of the tool forms presented below are associated with any of the later occupations—with the possible exception of some unifacial tools which could be Early Archaic in age. In particular, this might be the case since a few Early Archaic notched point types were recovered at the site. Early Archaic assemblages often exhibit unifacial tool forms virtually identical to Paleoindian assemblages (see Coe 1964; Daniel 1998; Goodyear 1974). At present, however, we know of no way to reliably identify those forms in the assemblage and we stipulate that some Early Archaic artifacts may be included in the assemblage discussion below. Nevertheless, we suggest that the potential presence of any Early Archaic artifacts in the assemblage is more apparent than real, primarily based upon a comparison of raw material types within the assemblage. For example, notched points ($n = 5$) only slightly exceeds the number of fluted points ($n = 3$), including four

notched points made of quartzite—a stone type not found in the presumed Paleoindian assemblage. What is more, the remaining notched point is made of a metavolcanic stone that also does not appear in the presumed Paleoindian assemblage. In contrast, a raw material link does exist between one fluted point and much of the rest of the assemblage. As will be discussed below, some 70% of the presumed Paleoindian assemblage is made of a single metavolcanic stone that includes one fluted point. In sum, while the possibility remains that some component mixing exists in the assemblage reported here, the tool-stone evidence suggests that a majority of the assemblage is Paleoindian in age. What later period artifacts that might be included would not substantially alter the interpretations put forth below.

In total, 111 tools and 274 lithic flakes were identified in the Pasquotank Paleoindian assemblage. Artifact classification is consistent with morphological types commonly documented in other Paleoindian assemblages. Among types identified in the Pasquotank assemblage are fluted points, *limaces*, end scrapers, side scrapers, graters, and a *pièce esquillée*. Standard metric attributes such as maximum length, width, and thickness were recorded for each tool (Table 4). Non-metric attributes recorded for each tool include stone type, blank type, and tool shape (see Moore 2002).

Bifaces

Bifaces are defined by the presence of patterned flaking, which is produced on both faces of the artifact, usually for the purpose of thinning the tool or producing a sharp edge. Only two classes of bifaces were identified in the Pasquotank assemblage: fluted points and other bifaces.

Fluted points. These specimens, of course, temporally define the assemblage as Paleoindian (Figure 2). These points have been previously recorded as numbers 8, 9, and 10 in the North Carolina Fluted Point Survey (Perkinson 1971:11–12) and will be referred to as such here. All three points are similar in form, characterized

Table 4. Pasquotank Site Tool Dimensions.

Type	N	Length		Width		Thickness	
		Mean	SD	Mean	SD	Mean	SD
Fluted points	1	42.4	-	21.3	-	7.1	-
<i>Pièces esquillées</i>	1	46.2	-	33.0	-	9.8	-
Type I end scrapers	42	28.3	7.5	22.7	4.3	7.3	2.0
Type III end scrapers	1	53.1	-	36.3	-	16.2	-
Type V end scrapers	1	53.4	-	32.2	-	7.0	-
Side scrapers	4	50.9	7.2	26.8	1.9	6.9	1.8
Pointed scrapers	1	38.2	-	19.5	-	6.9	-
<i>Limaces</i>	5	46.7	17.7	14.8	3.8	7.9	2.1
Flake graters	5	29.3	7.1	25.4	2.8	4.5	1.0
Hafted pokeshaves	2	28.2	7.6	22.6	4.3	7.3	2.0

Note: Dimensions are for complete specimens.

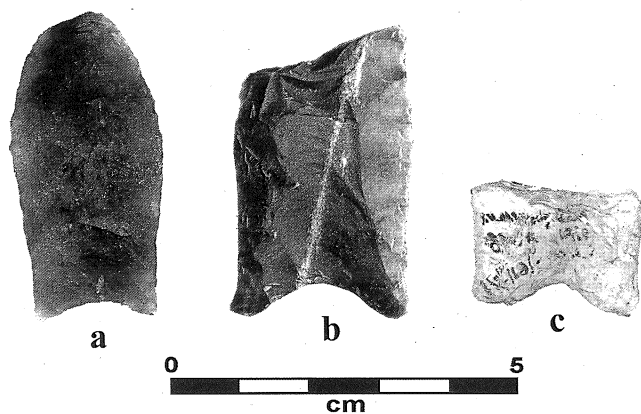


Figure 2. Fluted points from the Pasquotank site.

by a fluted concave base with parallel to slightly excurvate sides.

Fluted Point 8 (Figure 2c) is a small, crystal-quartz point base that measures approximately 24 mm in width at the ears. The break may represent a haft snap. Relatively shallow fluting is present on both faces. A single flute is present on the obverse face which was interrupted by the break. Two shallow flutes are present on the reverse face and may have extended shortly beyond the point where the specimen was broken. Grinding is present along both lateral edges and is interrupted by the break.

Fluted Point 9 is made of rhyolitic tuff (Figure 2b). It too is a broken specimen, but it includes the entire base and a portion of the blade. It is about 25 mm in width at the ears. Grinding is present along the lateral edges of the base. The break may be related to a possible impact fracture, the remnants of which are present on both faces of the blade. Fluting is present on both faces. The obverse face contains a single flute, the distal portion of which may have been intruded by the impact fracture. Two equally sized channel flakes form the flute on the reverse face.

Fluted Point 10 is a virtually complete specimen, 42 mm in length, displaying slight damage where the tip is broken (Figure 2a). This is likely a postdepositional break. The point is made of jasper. While the artifact exhibits an overall lanceolate form, blade shape is slightly excurvate such that the maximum width of the point (21 mm) is slightly below its midpoint. Basal width at the ears is about 17 mm. A single flute is present on the obverse face. Two or three shallow, overlapping channel flakes form the reverse flute. The ears and basal concavity on this specimen are relatively less pronounced than in the previous two specimens.

In sum, while these fluted points apparently lack some attributes typically considered diagnostic of Clovis such as overshoot flaking (Bradley 1991), the overall size, shape, and flaking patterns of these specimens are similar enough to the Clovis type that

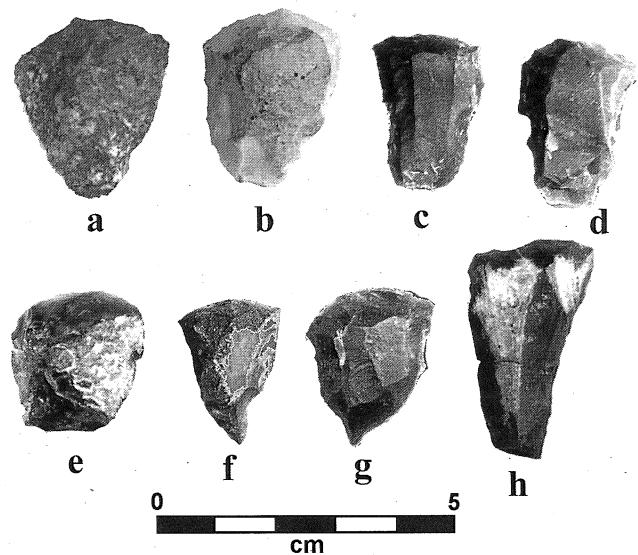


Figure 3. End scrapers from the Pasquotank site.

they could be labeled typologically as Clovis-like (see Haynes 2002:81–93). Whatever the case, these points are typical in form to the majority of fluted points recovered in North Carolina (Daniel 2000).

Other bifaces. The remaining seven bifaces are broken specimens including five distal and two body fragments. While it is uncertain that all bifaces are from the Paleoindian component, each biface is made of raw material represented by other tool types in the Paleoindian assemblage (Table 1). Mostly small to medium in size, these tools are relatively well made and are generally lenticular in cross-section. Assuming these bifaces are from the Paleoindian component, then one broken chert tip is sufficiently well flaked to represent the distal portion of a finished fluted point. The remaining specimens may represent rejected point preforms.

Unifaces

Unifaces represent the majority of tools present in the Pasquotank assemblage ($n = 102$). Unifaces are characterized by flaking across one surface of the tool designed to produce a working edge or to facilitate hafting.

End scrapers. End scrapers are defined by a steeply retouched and narrow convex bit or working edge that is transversely located with respect to the long axis of the tool. Three morphological types were identified in the assemblage following Coé (1964) and Daniel (1998).

Type I end scrapers ($n = 59$) are the dominant tool class representing over half the Paleoindian assemblage (Table 1). Distinctively uniform in morphology, Pasquotank Type I end scrapers are small and drop-like in plan view (Figure 3). All end scrapers except one appear constructed of blanks from bifacial cores. Bit

size for this tool averaged 21.7 mm in width. Presumably the small size of these end scrapers is due to the initial size of the blank and extensive use and reshaping.

Lateral retouch, designed to taper and reduce flake blank width to facilitate hafting, is present on all specimens. Other characteristics of hafting are present on these implements in varying frequencies including striking platform removal, thinned proximal elements, and the occurrence of lateral notches (see Keeley 1982). Certain breakage patterns among end scrapers may also indicate hafting. For example, 17 broken Pasquotank specimens exhibit bend or snap fractures at the presumed haft-blade juncture of the tool. Of these fragments, 13 were basal sections and four were distal (bit) sections. It seems unlikely that these small tools could have been used forcefully enough without hafts to cause this type of break (Goodyear 1974:44; Grimes and Grimes 1985:41). Another interesting attribute of these implements is the occurrence of graver spurs, a common feature on end scrapers in Paleoindian assemblages (e.g., Cox 1986:118; MacDonald 1968; Rule and Evans 1985). In the Pasquotank assemblage, spurs are generally present at the right or left corner of the bit edge (Figure 3d), although a few specimens exhibit spurs elsewhere on the tool. Whether these features were a deliberate design element or an incidental byproduct of reshaping cannot be resolved here (see Shott 1993:71–71). On the other hand, three end scrapers display graver spurs at their proximal ends directly opposite their bit edges that is interpreted to represent instances of end scrapers being converted into graters (Figure 3f, g). That is, these artifacts fall into the category of “secondary spurs” (see Rule and Evans 1985) created following scraper damage or exhaustion. If true, then this example of tool recycling has implications for site function and is addressed below.

Two other end scrapers in the assemblage exhibit different morphologies than Type I specimens and are classified as Type III or Type V forms (see Coe 1964:76; Daniel 1998:75–78). Type III end scrapers are similar to Type I end scrapers in shape and flaking patterns, only larger in size. The Type III end scraper in the Pasquotank assemblage also appears to have been made from a block-derived blank. The significance of the size difference between Type I and Type III end scrapers is unclear. For instance, comparing the thickness (16.2 mm) of one Type III specimen with the mean thickness (7.3 mm) of Type I end scrapers suggests the former was made on a blank form much thicker than typical for a Type I end scraper blank. Hence, this end scraper form simply may represent a tool manufactured for a relatively larger haft.

The single Type V end scraper is characterized by a narrow bit edge placed asymmetrically at the corner of the flake blank (Daniel 1998:76–77). The Type V end

scraper is distinguished from Type I and Type III end scrapers by straight to slightly incurvate lateral edges that expand rather than contract from the bit. This example was constructed from a relatively large, block-derived blank. Compared to hafted end scraper types, this tool exhibits less retouch along its lateral edges and only minimal proximal thinning on its dorsal surface. Unlike most Type I and Type III specimens, this tool also retains its striking platform. Taken together, its size and morphology suggests that this was an unhafted tool. For its size, this end scraper exhibits a narrow bit measuring 15.7 mm in width.

Given the large number of end scrapers in the assemblage, it is unlikely that all of them were lost or discarded in pristine condition. Instead, it is more likely that most were used to the point of depletion and then discarded. Indeed, most Type I end scrapers in the assemblage appear heavily resharpened, which likely reflects their status as a curated tool in the assemblage.

More will be said regarding tool curation below; here we examine the issue of tool reshaping among end scrapers. Various measurements of reduction intensity have been adopted to address the issue of tool reshaping and its relationship to curation among end scrapers in Paleoindian assemblages (e.g., Shott 1993; Walthall and Holley 1997). In particular, relative measures of end scraper length have been found to provide a rough measure of tool use (Blades 2003; Shott 1989, 1993:72–74). That is, given that end scrapers were retouched (and subsequently resharpened) for use at their distal ends, the maximum length of end scrapers should decrease as a consequence of reshaping. Hence, tool length should be the most reduced dimension in used specimens followed to a lesser degree by tool width (as maximum width corresponds to bit width). Tool thickness, however, should remain relatively constant as it is the dimension on tool blanks that remains least altered by tool reshaping. In fact, tool thickness has been used as a proxy for original blank length in end scraper analyses (Blades 2003) because it is necessary to know this value to determine the amount of reduction a tool has undergone. Accordingly, ratios of end scraper length to thickness have been used to quantitatively measure the intensity of scraper reduction in Upper Paleolithic assemblages (Blades 2003). Similar quantitative assessments of length, width, and thickness among Pasquotank end scrapers support the expectation of intense tool reduction of this tool class in the assemblage.

Boxplots displaying the distributions of length, width, and thickness for end scrapers by raw material show generally comparable values for length and width (Figure 4). Tool thickness, however, tends to be greater among chert end scrapers than metavolcanic specimens. (For purposes of this comparison, jasper end scrapers have been included with chert.) The remarkably similar

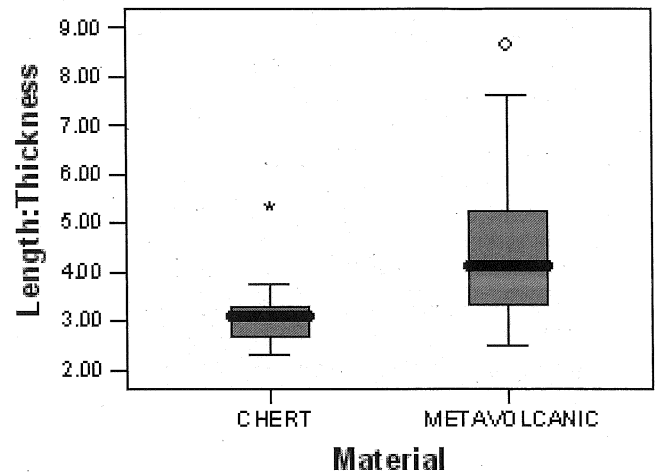
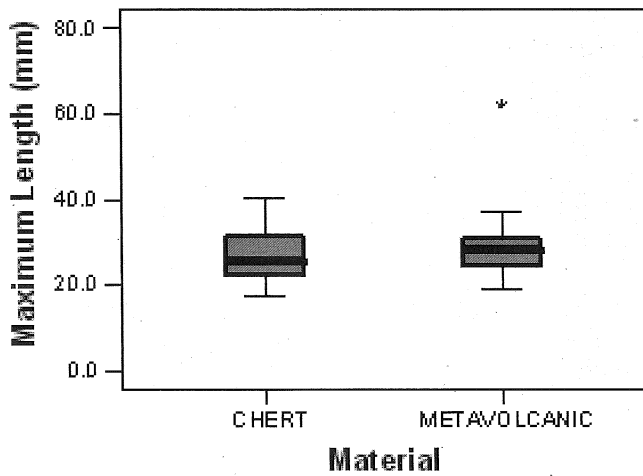


Figure 5. Boxplots of end scraper length:thickness ratios by stone type.

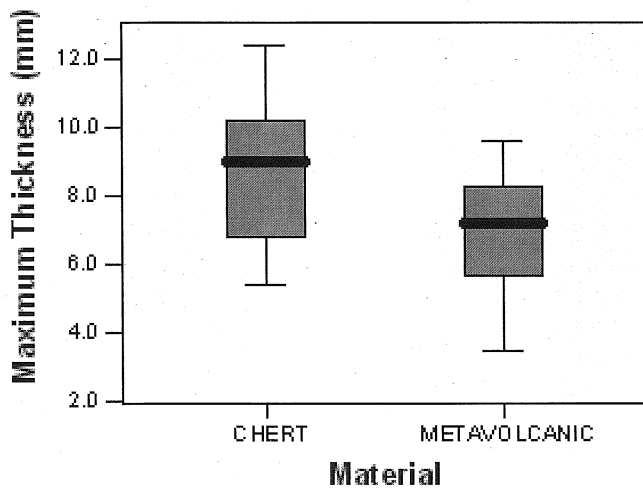
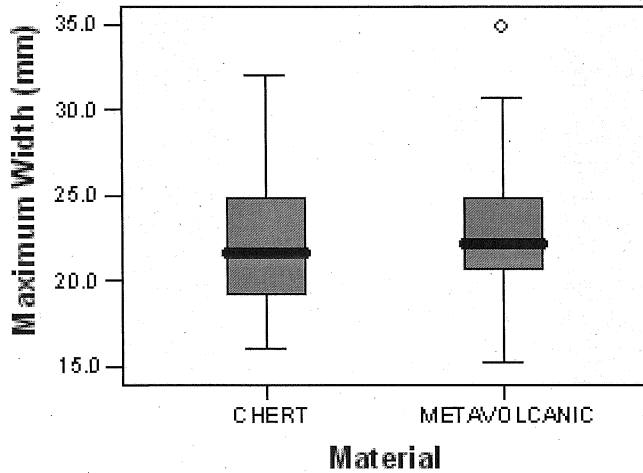


Figure 4. Boxplots of end scraper dimensions from the Pasquotank site.

values in length and width between chert and metavolcanic stone suggest a size range at which scrapers became unusable. That virtually all specimens fall within a range of 40–20 mm in length suggests a minimal length for tool use regardless of stone type. The comparable final lengths of the chert and metavolcanic tools, however, do not necessarily reflect the same degree of tool reduction for each stone type. This would be the case only if the original blank size of each stone type was equal. If, for example, the original blank length of one stone type was longer than the other, then end scrapers of that raw material would have undergone relatively greater reduction than tools made on comparatively smaller blanks. That this might be the case here is suggested by the tendency for chert end scrapers to exhibit greater thickness values than metavolcanic ones. Assuming that relatively greater thickness values reflects greater original tool length, then the comparatively lower length:thickness ratio distributions of chert versus metavolcanic stone depicted in Figure 5 suggest chert end scrapers underwent greater reduction compared to metavolcanic ones.

Nevertheless, we suspect that this may not be true in every case. Because at least some jasper end scrapers were manufactured from pebbles, the greater thickness of those specimens may likely reflect the relatively chunky characteristic of a pebble than a large flake blank. Thus, while Pasquotank end scrapers have undergone resharpening, interpretations comparing reduction intensities between raw materials should be viewed cautiously.

Some measure of the actual amount of reduction that the metavolcanic specimens underwent might be indicated by the extreme outlier value (62 mm) depicted in the length boxplot (Figure 4). This outlier likely reflects a specimen lost or discarded with considerable remaining potential utility. It is about

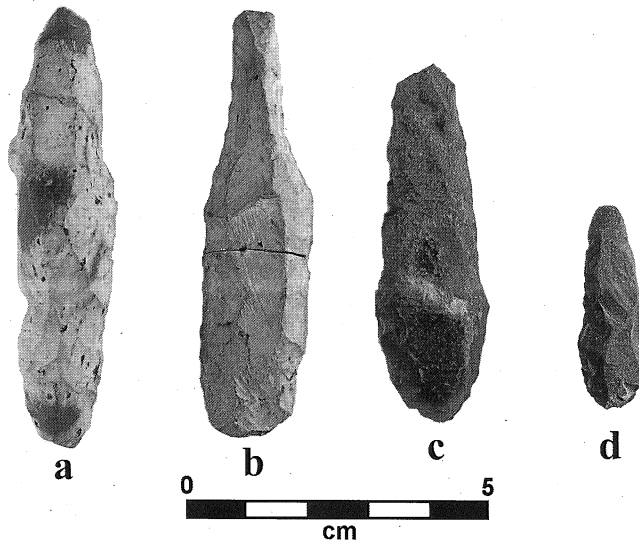


Figure 6. *Limaces* from the Pasquotank site.

45% longer than the median length represented for metavolcanic scrapers. That this specimen represents a lesser used tool in the assemblage, as opposed to a depleted end scraper made on a larger blank is suggested by its thickness value (7.2 mm), which is virtually identical to the mean value for Type I scrapers.

Based on ethnographic and experimental studies, end scrapers have been interpreted to function as hide scrapers (e.g., Hayden 1979; Keeley 1980:50; see also Walthall and Holley 1997). Indeed, a hide scraping function is frequently assigned to this tool class in Paleoindian assemblages (e.g., MacDonald 1968:114) and we assume this was also the case for most of the end scrapers in the Pasquotank assemblage. Moreover, we tentatively suggest at least some of these tools were made and used by women at the Pasquotank site. Following Hayden (1992), Walthall and Holley (1997:159–160) have made a case for interpreting end scrapers in a Dalton tool cache as material signatures of a female toolkit for hide processing. If end scrapers do reflect gender specific activities during Dalton times, we see no reason why this interpretation would not also apply to Paleoindian times as well. Further implications of this interpretation with regard to site function are considered below.

Limaces. Eleven *limaces* were identified in the assemblage (Figure 6). This total includes five complete specimens (including one reconstructed from two fragments), three fragmentary specimens, and three specimens that were recycled either into spokeshaves ($n = 2$) or graters ($n = 1$). *Limaces* are defined by their slug-shaped morphology and are interpreted to have been hafted tools (Gramly 1982:38; Grimes and Grimes 1985). The regularized slug shape results from extensive lateral retouch that tapers both ends of the tool. As

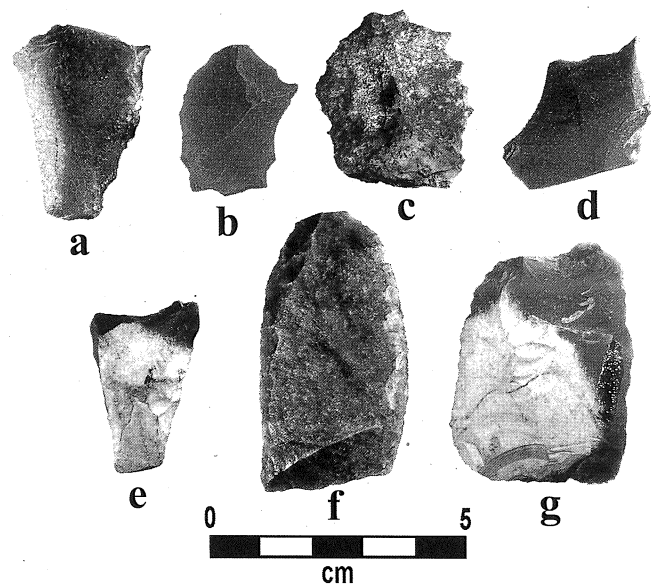


Figure 7. Other chipped-stone artifacts from the Pasquotank site.

is typical for this class, these examples exhibit a slight to distinct shouldered appearance located about one-quarter to one-half the distance from the proximal end of the tool. Presumably, this preparation facilitates hafting (Grimes and Grimes 1985:40). At least four specimens display proximal thinning on both dorsal and ventral surfaces. The three fragmentary tools include two proximal and one distal sections. As with end scrapers, these may represent “haft-breaks.” The break on the refitted tool, however, may be post-depositional as the surfaces on the breaks are unweathered compared to the weathered exterior surfaces elsewhere on the two fragments.

Limaces are common among fluted-point sites in the Northeast, including Debert (MacDonald 1968:98–99), Vail (Gramly 1982), and Bull Brook (Byers 1954:348–349). This tool form appears to be relatively uncommon in the Southeast, however. Some *limace* fragments may be present in the hafted side scrapers reported at Dust Cave (Randall 2001). *Limace*-like forms also may be represented in the oblong scraper uniface category at Harney Flats (Daniel and Wisenbaker 1987:70–74). In any case, *limaces* have been interpreted as shaving or whittling tools applied to hard materials such as bone, ivory, wood, or antler (Grimes and Grimes 1985:40). Presumably, these tools were used for similar functions at Pasquotank.

Flake graters. Seven flake graters were identified in the assemblage (Figure 7a–d). Graters are characterized by relatively short, unifacially flaked, needle-like projections that range from 1.2 to 5 mm in length. Except for the projection, the flake blank is otherwise unmodified. Most graters were manufactured from bifacial flakes, which were generally small in size

(Table 4). Most flake gravers exhibit only a single bit, although one specimen exhibits three bits and another specimen displays five bits. Typically, graver bits were located at the distal end of the flake. However, multiple-bit gravers exhibit bits on the lateral edges as well. Traditionally, gravers have been interpreted as tools for etching or slotting bone, antler, or wood (e.g., Goodyear 1974:55; MacDonald 1968:100). We assume the Pasquotank gravers were used in a similar manner.

Spokeshaves. These specimens ($n = 2$) are defined as unifacial tools that exhibit a concave bit edge formed by unifacial retouch (Figure 7e). The concave bits on these specimens appear to be manufactured on the broken distal edges of *limaces*. Both tools are similar in size (Table 4). Because both tools were apparently recycled from the ends of two *limaces*, they both exhibit similar morphologies with the lateral edges of each tapering away from the bit. In as much as this tapering results in tool morphology resembling Type I end scrapers, it is likely these spokeshaves were intended to be hafted tools. Indeed, these tools closely resemble the hafted spokeshave tool type identified elsewhere in the Southeast (Goodyear 1973, 1974).

Experimental replication has shown that when pushed into the surface of soft pine, spokeshaves served as an excellent miniature plane, producing large wood shavings. Applied in the same manner, spokeshaves could also be used to smooth the convex surfaces of long bones or antler (Goodyear 1974:50–52). We suggest these tools were likely used to work wood, bone, or antler at Pasquotank.

Side scrapers. Side scrapers are defined as unifacial tools that exhibit one or more retouched bit edges parallel to the long axis of the tool. Side scrapers from the Pasquotank assemblage ($n = 9$) were grouped into a single category. Although there is morphological variability in this class, these tools are relatively narrow in width as compared to length (Table 4). All side scrapers were constructed from block-derived flakes. No evidence for hafting was observed among side scrapers, although two side scrapers exhibit some proximal thinning, which was executed in shaping a portion of the bit edge.

Three side scrapers are constructed on whole or nearly complete flake blanks. One blade-like chert specimen possesses two parallel working edges (Figure 7f). This tool exhibits well-executed, unifacial retouch along both lateral edges, resulting in straight to slightly convex bits. A second side scraper exhibits a single, straight to slightly convex bit, while the third exhibits a slightly concave bit edge. Most side scrapers ($n = 6$), however, occur on incomplete flake blanks. Whether these specimens represent portions of broken tools or tools made from relatively large flake fragments is unclear. With respect to bit shape, five of these tools exhibit a single retouched edge that is straight to

slightly convex. A final specimen exhibits an irregularly shaped, almost serrated bit edge.

The function of side scrapers is open to question. If morphological variability relates any way to use, then this type may exhibit more functional variability than postulated for end scrapers. Alternatively, tool morphology may reflect stages in edge rejuvenation beginning with large utilized (but otherwise unmodified) flake blanks (cf. Dibble 1987). Similar conclusions have been reached with other Paleoindian assemblages (Ellis and Dellar 1988:128). In either case, side scrapers may have been used for a number of activities. With respect to the Pasquotank assemblage, we speculate these specimens represent expedient tools used for a range of cutting and scraping tasks.

Pointed scraper. Only one pointed scraper was identified in the assemblage. Pointed scrapers are defined as a side scraper that exhibits retouch along both lateral edges, designed to form a definite point (Coe 1964:79). This tool was manufactured from a medium-sized bifacial flake. The significance, if any, of the "pointed" nature of the retouch is unknown but it likely represents a product of edge rejuvenation rather than manufacture per se.

Uniface fragments. Twelve uniface fragments were identified in the assemblage, representing unifacially retouched artifacts that were too broken to assign to any of the previous categories. Most ($n = 9$) fragments appear to represent small sections of broken end scrapers. Six of these fragments appear to be bit remnants while three resemble basal remnants. The remaining three fragments appear to be bit sections from broken side scrapers. There is no clear indication whether these breaks were the result of tool use or simply the result of post depositional processes.

Core and Flake Debris

Other than the bifaces identified earlier or the *pièce esquillée* described below, no other artifacts were identified as possible cores in the assemblage.

Pièces esquillées

Only one *pièce esquillée* was identified in the Pasquotank assemblage, but it is significant because of the artifact's association with Paleoindian sites (e.g., Goodyear 1993; Gramly 1982). It is roughly rectangular in shape and is one of the largest artifacts in the assemblage (Table 4). The *pièce esquillée* originally appears to have been a side scraper as it exhibits fine, regular unifacial retouch on alternate faces along the length of both lateral edges (Figure 7g). Furthermore, the unifacial retouch pattern is similar to that present

Table 5. Frequency Distribution of Flake Type and Size.

Flake Type	Size 1 (<6 mm)	Size 2 (6-12.7 mm)	Size 3 (12.7-25.4 mm)	Size 4 (>25.4 mm)	Total	%
Biface	0	123	43	4	170	62.1
Block	0	10	5	5	20	6.9
Indeterminate	45	19	19	1	84	31.0
Total	45	152	67	10	274	100
Percentage	16.5	55.4	24.5	3.6	100	

on the side scrapers described above. Both ends of this specimen show evidence of bipolar percussion characteristic of *pièce esquillées*. The ends are battered and slightly crushed exhibiting step- and hinge-flake scars along one-third to one-fourth of the tool length.

Pièces esquillées have been interpreted as bipolar cores or as wedges for splitting organic materials like wood, bone, or antler (Goodyear 1993; Hayden 1980; MacDonald 1968:88; Shott 1989). Although either functional interpretation (core/wedge) of this artifact is possible, given the scarcity of flakeable stone at Pasquotank, it seems more plausible to interpret this *pièce esquillée* as a side scraper recycled into a bipolar core—an interpretation consistent with other examples of tool recycling in the assemblage.

Debitage

A total of 274 flakes are present in the assemblage. The results of the flake analysis will be only summarized here (see Moore 2002:45-48). According to Pritchard, debitage collection at the site was neither systematic nor comprehensive. Nevertheless, the small size of most flakes in the assemblage and their variety of raw materials suggests that surface collection was more thorough than he suspected. Still, as a whole, results from debitage analysis must be viewed cautiously. For instance, the low occurrence of quartz and the absence of quartzite in the debitage are probably due to a bias in field collecting, given the abundance of these materials in the Archaic and Woodland assemblages and Pritchard's admitted bias against collecting artifacts of these materials. Perhaps the most serious bias, however, is that we have chosen to include all the debitage in the analysis even though at least some of these data must represent later occupations at the site. Nevertheless, this bias may not be too problematic since six of the eight stone types identified in the flaking debris are also found in the Paleoindian assemblage.

Initially, flakes were sorted according to material type and size. Classification of stone types followed the classification scheme used for the tool assemblage (Table 2). Four size grades were identified in the debitage. Flakes were then classified according to whether they derived from a biface, a block core, or an indeterminate core (Table 5). A number of defining

attributes were used to determine whether a flake was derived from a bifacial or a block core. In brief, biface-derived flakes exhibited some or all of the following attributes: small, faceted platforms, acute platform angles, a dorsal surface exhibiting a complicated flake scar pattern, and a pronounced curvature longitudinally (Moore 2002:45-46). Block core-derived flakes, on the other hand, tended to exhibit flat striking platforms with obtuse platform angles and thicker cross-sections. Moreover, dorsal-surface flake scar patterns are less complex and more unidirectional than biface-derived flakes. Suffice it to say that two trends emerged in the analysis. First, most of the stone types identified among the flakes are represented in the tool assemblage. In particular, rhyolitic tuff dominates both the debitage and tool classes in virtually the same frequency (ca. 70%). Debitage of this material is almost certainly associated with the Paleoindian component. Relatively minor amounts of aphyric rhyolite, Type I chert, and jasper are present in the flake collection and are likely associated with the Paleoindian component as well. Second, biface thinning appears to represent an important stone working activity at the site. Over 60 percent of the flakes were derived from bifacial cores. Less than 10 percent of the flakes could be classified as block core-derived. The remaining portion of the collection could not be confidently classified due either to their small size or broken condition.

The character of the debris collection, when combined with the tool analysis results, permits some limited inferences regarding the form in which stone was imported to Pasquotank. The results of the flake analysis suggest the rhyolitic tuff at Pasquotank was likely the primary tool-stone worked at the site, which is consistent with the predominance of this stone type in the tool assemblage. Stone reduction also occurred to a lesser degree on aphyric rhyolite, Type I chert, and jasper—all stone types represented in the tool assemblage. Given the preponderance of flakes derived from late stages in the reduction continuum, most raw materials were probably imported in finished or partly reduced form in the case of bifaces and finished or tool blank form in the case of unifaces. In fact, the preponderance of small biface thinning flakes in the assemblage suggests that these materials were probably carried to the site in the form of partially reduced bifacial cores or preforms—a few of which were recovered as

production failures from the site. Admittedly, no direct evidence was presented in the flaking debris to support the notion that unifacial tool blanks were imported to the site. However, given the absence of blocky cores, and the presence of a few unifacial tools produced from block cores, it is probable that several of the intended unifacial tools were brought in as relatively large flakes or tool blanks. Uniface production requires less extensive modification of preforms than does biface production, and unifaces could have been brought to the site in any form from flake blanks to finished tools. Some of the small flakes classified as being removed from a block core conceivably could have been unifacial retouch flakes. More likely, given the small size of the recovered unifaces, the flakes associated with finishing or maintaining those tools were so small as to have gone unrecognized (i.e., classified in the indeterminate category in Table 5) or not recovered.

Summary

The Pasquotank assemblage has been described both for the simple sake of description and to indicate the similarities the various artifact types share with other Paleoindian assemblages. To this point, some limited inferences also have been drawn with respect to how certain tools were made and the correspondence between morphological and functional types. Furthermore, some limited inferences also were made regarding the nature of the stone working activities conducted at Pasquotank based on the debris analysis. Taken together, the character of both the tool and debris assemblages allows further speculation regarding the organization of the technology with respect to the design of transported toolkits and to the possible conditions under which the various artifacts came to enter the archaeological record at Pasquotank.

Toolkits and Technological Organization

Stone tool assemblages reflect the larger contexts of the location and conditions under which they were produced, used, maintained, and discarded. Moreover, the perspective of technological organization—the concept that stone tool technologies were spatially, temporally, and functionally organized—is now being used as a method of understanding aspects of cultural systems such as site function and settlement adaptations (Binford 1977, 1978, 1979; Kelly 1988; Nelson 1991). Though relatively small in size, the Pasquotank assemblage comprises a variety of tool types but is dominated by a single tool class (end scrapers) and a single high-quality raw material (a dark green rhyolitic tuff). The array of artifacts in the Pasquotank

assemblage are interpreted to represent some portion of a portable hunter-gatherer toolkit. A portable toolkit

refers to artifacts that mobile individuals keep with them most or all the time, implements that are subject to virtually continuous transport.... Mobile toolkits are an important component in the technologies of all foraging populations. Raw materials are seldom ubiquitous, and even when they are, it is often neither practical nor convenient to stop and make tools as needs arise. As a consequence, it is advantageous to keep a limited inventory of implements on hand at all times, as a hedge against unpredictable but unavoidable exigencies (Kuhn 1994:427).

Regarding the Pasquotank toolkit, three design characteristics stand out that provide insight into prehistoric foraging adaptations: high-quality tool-stone, tool curation, and tool recycling.

High-Quality Tool-Stone

Perhaps the most important element in a mobile toolkit is tool-stone. High quality lithic raw material is a hallmark of Paleoindian assemblages (e.g., Goodyear 1989). Basically, mobile Paleoindian groups maximized the efficiency of their tools by using high-quality, knappable stone to ensure a portable and flexible technology (Goodyear 1989). Moreover, North American fluted-point assemblages are often dominated by a single exotic stone type that is interpreted to have been acquired directly from an outcrop (Goodyear 1989; Meltzer 1984, 1988). The Pasquotank assemblage certainly fits this pattern with roughly 70 percent of the tools and debitage being made from a siliceous metavolcanic stone likely exotic to the North Carolina Coastal Plain. This tool-stone can be observed in every artifact class including fluted points. Chert constitutes the second most abundant stone type in the assemblage at about 12 percent of the tools followed by jasper at 9 percent. Together, these two raw materials are found in two-thirds of the tool classes. Four other metavolcanic stone types are also present in the tool assemblage but together account for about 8 percent of the total. Wherever the sources were located, the chert and metavolcanic stone in the Pasquotank assemblage almost certainly originated outside the North Carolina Coastal Plain.

Evidence that the Pasquotank occupants were some distance from their tool-stone source (or at least not concerned with quarrying activities at Pasquotank) is also indicated in an intersite comparison of tool production: tool use ratios. Meltzer (1988:29–31) has shown that eastern fluted-point assemblages comprised primarily of nonlocal stone have much lower ratios of production tools (e.g., hammerstones, anvils, and abraders) plus debitage to utilized tools (generally less than 5:1) than do assemblages of local stone. Assemblages with local stone display ratios several times higher than 5:1. Meltzer (1988:30) also interprets

assemblages with so much debris relative to actual tools as probably quarry related. The possible bias in artifact recovery notwithstanding, a ratio of 2.5:1 certainly puts the Pasquotank assemblage in the non-local source category.

Tool Curation

Tool curation is also an important criterion of a mobile tool kit (Kuhn 1994:427). Here we use the term "curation" primarily in the sense of preparing and carrying either cores or tools in anticipation of future use (Binford 1977, 1979; Odell 1996). It should also be apparent that tool curation is closely associated with high-quality stone, since the fine-grained quality of this material allows implements to be maintained through numerous resharpenings (Goodyear 1989). Indeed, in addition to the observation that eastern North American fluted-point assemblages are often dominated by exotic stone, those specimens are often worn roughly in proportion to the distance from stone source (Meltzer 1988:26–28), suggesting that those implements were used and maintained during their transport. Accordingly, tool curation is represented in the Pasquotank assemblage among fluted points, bifaces, end scrapers, and *limaces*. This inference is based on the fact that these artifacts display several characteristics generally associated with curation including being made from high-quality, knappable stone (e.g., Goodyear 1989) and exhibiting a formalized morphology associated with regularized maintenance (Kelly 1988) and/or hafting requirements (e.g., Keeley 1982).

Bifaces are perhaps the quintessential curated implement (Kelly 1988). Points and other bifaces represent curated implements at Pasquotank. The few points present in the assemblage were apparently discarded at Pasquotank because they were broken or exhausted. As noted above, the category other bifaces may represent failed point preforms, but this does not prevent them from previously serving as portable cores (cf. Goodyear 1989; Kelly 1988; Kuhn 1994). Because bifacial cores allow the consistent removal of usable flakes, they likely provided flake tool blanks (e.g., for graters or end scrapers) at Pasquotank as well as serving as a long use-life tool. Hence, it is possible that limited replacement of other curated tools in the tool kit, such as end scrapers, could have occurred at Pasquotank to replace discarded specimens.

Type I and possibly Type III end scrapers as well as *limaces* were curated implements in the toolkit. As discussed above, considerable evidence exists for these specimens having been hafted tools. In addition, heavy resharpening is particularly evident among Type I end scrapers and *limaces*. While the working edges for composite tools can be made relatively quickly, the

effort spent to haft bits usually implies an extended use-life (Keely 1982). When the evidence for extended use-life is combined with the fact that these tools were generally made from nonlocal stone, then a case can be made for their classification as curated items in the tool kit.

A lesser level of curation is indicated for side scrapers, graters, and perhaps the single Type V end scraper. We suggest that they represent more expeditiously made and used tools in the assemblage. Some side scrapers, for example, were probably made at Pasquotank from blanks transported to the site. Likewise, flake graters were likely produced from bifacial cores at the site. If this interpretation is accurate, it illustrates how curated and expedient technological strategies can be linked, representing technological responses to particular conditions (Nelson 1991:62–66). For example, if flake blanks were transported as part of the Pasquotank tool kit, the action of acquiring the stone and transporting it to a use location anticipates future needs and would represent a curated strategy. However, transporting raw material in this fashion facilitates the manufacture of tools (e.g., side scrapers) as they are needed, an expedient strategy. Hence, these concepts do not define a Pasquotank artifact class or assemblage type. Rather, the artifact forms and assemblage composition at Pasquotank represent the ways in which both curation and expediency were implemented in the technology.

Tool Recycling

Finally, evidence for tool recycling in the assemblage also fits the criteria of a mobile toolkit (Goodyear 1989; Nelson 1991:74–75). Following the expectation that transported tools should be conserved by maximizing their use-lives, tool recycling provides for a long and variable tool use-life. Of course, recycling is also facilitated by the use of high-quality, knappable tool-stone such as is present in the Pasquotank assemblage. Evidence of tool recycling at Pasquotank can be seen in several examples of functional shifts in tool morphology. For example, three exhausted end scrapers and one exhausted *limace* were converted into graters. Likewise, two *limaces* appear to be transformed into spokeshaves. Another example of tool conversion at Pasquotank can be seen in the case of a broken side scraper that was converted into a *pièce esquillée*. Given that *pièces esquillées* appear mostly at sites where raw material was so scarce that a bipolar technique would have been necessary to strike useful flakes (Goodyear 1993), a core interpretation for the artifact at Pasquotank is in line with the stone-depleted appearance of the assemblage.

These occurrences represent an example of "flexibility" as a design variable in the assemblage: "A flexible tool can be reshaped easily to meet a variety of needs"

(Nelson 1991:70). An obvious implication of this occurrence at Pasquotank is the occupants lacked the raw material to make new tools required to perform certain activities at the site. Expended implements in the toolkit, then, provided the necessary raw material to manufacture needed tools. In short, this behavior indicates an overall toolkit design strategy intended to accommodate the constraints of high mobility in an environment of low stone raw material availability.

These recycling occurrences, of course, are not unique to Pasquotank as similar recycling examples have been identified in other Paleoindian assemblages. Converting end scrapers into graters, for instance, has been noted at the Vail site (Gramly 1982:34–35). At Vail, such occurrences were interpreted to indicate a raw material shortage reflecting an extended period of time since the inhabitants had last visited a stone quarry.

In sum, assuming that toolkit design represents a particular response to different conditions or strategies for using the environment, then the above discussion regarding assemblage composition has implications for Paleoindian landscape use in the North Carolina Coastal Plain. As discussed below, the tool-stone in the Pasquotank assemblage was carried over great distances. It seems evident the focus on the acquisition of high-quality tool-stone combined with the practice of tool curation and recycling reflects a strategy to reduce tool-stone bulk while maintaining toolkit flexibility as it is carried to locations of tool use.

Functional Variability in the Toolkit

If the recognition of a forager toolkit can be viewed as a first step toward understanding Paleoindian technological organization, another level of analysis includes understanding Paleoindian landscape use as reflected by how these toolkits are distributed archaeologically. The above discussions regarding the selection of tool-stone, tool curation, and tool recycling all have implications for understanding forager land use as reflected in assemblage composition at Pasquotank. In this section we make inferences concerning site function and settlement mobility based on some assumptions concerning how technological organization influences the distribution and discard of tools and their manufacturing debris (Binford 1980; Nelson 1991).

Site Function

With regard to Pasquotank, the above analyses have indicated that primary stages of tool production, including core preparation and tool blank production did not occur at the site. Rather, the preponderance of late-stage flaking debris attests to lithic reduction

practices at the site weighted toward finishing and maintenance. In fact, the character of the entire assemblage is one of retooling—toolkit maintenance rather than toolkit (i.e., stone) provisioning. This interpretation also takes into account the Pasquotank site's location in a stone-deprived environment making acquisition of stone in the quantities necessary to replenish entire toolkits unlikely. Thus, the Pasquotank assemblage does not fit the quarry-workshop pattern ascribed to most known fluted-point assemblages in the Southeast (Meltzer 1988:40–41). Instead, tool-stone was transported a great distance to Pasquotank as flake blanks for unifaces and as bifacially worked preforms/cores for tools such as points. Of course, finished implements were also imported to Pasquotank, many of which were probably near depletion as in the case of end scrapers and *limaces* in the assemblage.

Taking this inference regarding retooling activities at Pasquotank a step further, we propose it was performed during a relatively brief residential occupation by a small social unit including one or a few family groups. While the inference of the social context regarding assemblage formation is speculative, this interpretation is based on a few assumptions. First, we assume that tool finishing and repair are primarily done at residences where time and raw materials are more readily available than at special activity or task specific sites (see Nelson 1991:78–81 and references cited therein). Kelly, for example, has suggested that “bifaces which are fit to hafts might be more frequently maintained or replaced in residential sites where the necessary stone or organic materials might be kept, rather than out at logistical site” (1988:721). The same should be true for hafted unifaces as well. Because time budgeting is critical to foragers (e.g., Torrence 1983), the scheduling of activities including the manufacture and repair of tools is important to maximize the use of resources. At Pasquotank we assume retooling was scheduled during a period of downtime between maintenance activities associated with a residential occupation.

Of course, downtime is not associated exclusively with residential occupations; it also occurs at camps of shorter occupancy that often include segments of a residential group, as illustrated by the manufacture and maintenance of tools at hunting stands of the Nunamiut (Binford 1978). However, we regard a “male hunting camp” interpretation for Pasquotank as unlikely based on another assumption: if end scrapers indicate women's tasks (as noted above), and points and bifaces reflect men's tasks (as generally considered), then group composition at Pasquotank consisted of one or more entire social units rather than other settlement types such as a male hunting camp.

Moreover, a residential interpretation is also consistent with the typological “richness” (i.e., the number of

tool types) in the Pasquotank assemblage—including both curated and expedient implements—implying a relatively broad range of activities (beyond just toolkit maintenance) were undertaken at the site.¹ For instance, breakage patterns among end scrapers suggest at least some curated tools were used at the site and not simply transported to Pasquotank for replacement. At least 30 percent ($n = 17$) of the end scrapers were broken, including both bit and butt fragments. While it is arguable whether the presence of tool butts at Pasquotank actually reflects tool use at the site (i.e., the implements could have been broken elsewhere but the hafted remnant transported to Pasquotank in anticipation of being replaced), the presence of end scraper bits in the assemblage are likely the result of tool use at the site. We suggest, therefore, that at least some end scrapers (and by implication other curated tools at Pasquotank) were used to some extent at Pasquotank prior to being discarded. Likewise, additional activities were carried out at the site as reflected in the presence of more expediently made and used tools like side scrapers and graters.

In sum, whatever their specific uses, the artifacts from the Pasquotank assemblage can be sorted into broad functional classes presumably related to hunting and butchering (e.g., points and bifaces), food and raw material processing (including a variety of unifacial tool types), and tool maintenance (flaking debris). Taken together these data suggest site activities associated with residential occupations.

Examining toolkit variability from a regional perspective also provides some basis for interpreting site function (Meltzer 1984:33–41). Formal comparisons between Pasquotank and other Southeastern fluted-point assemblages, however, are made difficult for several reasons, not the least of which is the paucity of fluted-point assemblages in the Southeast (Goodyear 1999; Meltzer 1988). Perhaps even more problematic is the issue of ensuring analytical comparability between Pasquotank and the few Paleoindian assemblages that do exist. The difference in recovery methods, for example, between a surface-collected assemblage like Pasquotank and an excavated assemblage like Thunderbird (Gardener 1977, 1989) are difficult to reconcile. Nonetheless, at least one observation regarding inter-assemblage variability seems warranted. Clearly, distance from stone source has influenced assemblage composition at Pasquotank. In this regard, Pasquotank appears to represent an exception to the pattern of known Southeastern Paleoindian assemblages such as Thunderbird (Gardener 1977, 1989) and Williamson (McCary 1951) that are located near tool-stone sources and have quarry-related functions (Meltzer 1988:26–28). Analytical comparability notwithstanding, the character of the Pasquotank assemblage, including the

range and condition of tool types (including the preponderance of end scrapers), and the distance to stone source are reminiscent of fluted-point assemblages in the Northeast. Furthermore, Pritchard's observation that the assemblage comprises several artifact clusters is certainly consistent with the pattern of spatially discrete artifact concentrations or loci widely reported for Northeastern fluted-point sites (see summaries by Dincauze 1993; Meltzer 1988). Unfortunately, any potential examination of the presence of intrasite spatial patterning at Pasquotank is precluded by the lack of controlled surface collection.

Settlement Mobility

Identifying raw material sources in stone tool assemblages has provided important information concerning the scale of Paleoindian mobility (e.g., Meltzer 1984, 1988). Because most eastern Paleoindian assemblages are dominated by a single stone type that appears to have been acquired directly from its geological source, the distance between the natural and archaeological occurrences of this stone are often used as a rough measure of prehistoric mobility. Accordingly, distances up to 300 km are commonly cited in the literature regarding the transport of Paleoindian tool-stone (Meltzer 1988:26–28, 1993:304–305).

While it bears emphasizing that the stone sources identified here are provisional, it does appear that tool-stone in the Pasquotank assemblage was acquired a great distance from the site. A single metavolcanic stone dominates the assemblage whose closest possible source may have been located about 140 km to the northwest along the Nottoway River. Alternatively, possible sources might be present in the Eastern Slate Belt about 140 km to the west or the Carolina Slate Belt at least 200 km farther west. Furthermore, if Uwharrie rhyolite is present in the assemblage, then at least some metavolcanic stone was acquired some 360 km from Pasquotank. Chert and jasper, a distance second in abundance to metavolcanic stone in the Pasquotank assemblage, were likely nonlocal to Pasquotank as well and may have been acquired from the Virginia Fall Line about 140 km to the northwest (Figure 1).

While inferences regarding settlement mobility are difficult when the system is viewed from the perspective of a single site, what might be said regarding settlement mobility with respect to the Pasquotank assemblage? Perhaps the most parsimonious interpretation of the above pattern of stone use is that the Pasquotank assemblage represents the direct acquisition of various stone raw materials from the Fall Line of southern Virginia. A settlement range encompassing the Nottoway and Pasquotank rivers is suggested.

Speculating further, the minor amounts of aphyric (and perhaps porphyritic) rhyolite are interpreted to have been acquired via exchange with groups to the west whose settlement range focused on Uwharrie rhyolite along the Yadkin River, thus expanding their geographic range of adaptation (cf. Ellis 1989).

Another possibility is that all the stone types were acquired directly by a single group as a part of its annual round, moving in some fashion amid the Fall Line of southern Virginia, the Carolina Piedmont, and the upper Coastal Plain of North Carolina. This alternative, however, might be less likely than the first interpretation, since such a route would almost certainly greatly exceed the 300 km distance commonly cited for the maximum extent of Paleoindian tool transport. Yet another interpretation might include a pattern of stone use that represents visits by two social groups to Pasquotank—utilizing tool-stone from the Piedmont and Fall Line, respectively—with largely separate settlement ranges that partially overlap in the vicinity of the Dismal Swamp. Whether these occupations would have been contemporaneous (as in an “aggregation site”) or separate can only be speculated upon.

In sum, then, it is perhaps not surprising that no straightforward interpretation regarding settlement mobility is possible. Whatever the explanation, it would appear that Paleoindian mobility in at least some portions of the Southeast rivaled that of the Northeast (see Meltzer 1988:26–28).

Conclusion

The analysis of the Pasquotank assemblage is an important addition to the study of Paleoindian archaeology in the Southeast. While productive research has been done in the region using Paleoindian point data gathered from statewide surveys, analyses of entire stone tool assemblages are needed to provide insights into Paleoindian groups as functioning cultural systems. Accordingly, the Pasquotank assemblage is interpreted here as part of a mobile toolkit designed such that it could be used to procure resources some distance from where the toolkit was provisioned. Tool design and the staging of manufacture, use, and reuse balanced the constraints of mobility with the need to have a usable tool at a specific time and place. Moreover, the assemblage can be used to evaluate propositions regarding hunter-gatherer technological organization (e.g., Kuhn 1994). For example, assuming that optimizing the utility of implements relative to their weight is a critical factor in designing mobile toolkits, the prevalence of small implements in the Pasquotank assemblage would appear consistent with the notion that it is more economical to carry several smaller tools than one big core of equivalent mass. Moreover, at least

with respect to end scrapers in the assemblage, the analyses here is also consistent with the idea that the most economical solution is to carry small tools between 1.5 and 3 times their minimum usable size (see Kuhn 1994:435–436).

Still, the presence of bifaces in the assemblage points to the advantages of having at least one relatively large implement on hand (Kuhn 1994:436–439). Presumably, the larger size of bifaces allowed them to be used in heavy pounding or chopping tasks that relatively small unifaces in the assemblage could not accomplish. The transport cost of carrying bifaces was offset by their unique flexibility: bifaces served as a cost-efficient source of flakes and preforms for tools as well as being good heavy-duty tools themselves. Although use-wear analyses are needed to address the inference made here regarding the dual role of bifaces and the speculated functions of the unifacial tools, it is apparent that functional flexibility was an important design variable in the Pasquotank assemblage (Nelson 1991:70–72). Unifacial tools were maintained to the extent that they could be reshaped to meet a variety of needs, an obvious advantage when raw material was in short supply. Whatever the planned functions of the Pasquotank tools, it was likely the case that the need to carry a tool influenced its form more than its intended use. The results of this study suggest that Southeastern Paleoindian toolkits were just as sophisticated as those elsewhere in North America.

Notes

Acknowledgments. The authors would like to thank Boyce Driskell, Al Goodyear, Asa Randall and an anonymous reviewer for their helpful comments on an earlier draft of this manuscript. Thanks are also due to Chris Moore who prepared Figure 1.

¹ This statement is tempered by the fact diversity varies with sample size (e.g., Kintigh 1984)—a fact that has not been accounted for here.

References Cited

- Binford, Lewis R.
1977 Forty-Seven Trips: A Case Study in the Character of Archaeological Formation Processes. In *Stone Tools as Cultural Markers: Change, Evolution, and Complexity*, edited by R. V. S. Wright, pp. 24–36. Australian Institute of Aboriginal Studies, Canberra.
- 1978 Dimensional Analysis of Behavior and Site Structure: Learning from an Eskimo Stand. *American Antiquity* 43: 330–361.
- 1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255–273.

- 1980 Willow Smoke and Dog's Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:1-20.
- Blades, Brooke S.
- 2003 End Scraper Reduction and Hunter-Gatherer Mobility. *American Antiquity* 68:141-156.
- Bradley, Bruce
- 1991 Flaked Stone Technology in the Northern High Plains. In *Prehistoric Hunters of the High Plains*, edited by George Frison, pp. 365-395. Academic Press, San Diego, California.
- Byers, Douglass
- 1954 Bull Brook—A Fluted Point Site in Ipswich, Massachusetts. *American Antiquity* 19:343-351.
- Coe, Joffre L.
- 1964 *The Formative Cultures of the Carolina Piedmont*. Transactions 54 of the American Philosophical Society. Philadelphia.
- Cox, Steven L.
- 1986 A Re-Analysis of the Shoop Site. *Archaeology of Eastern North America* 14:101-70.
- Daniel, I. Randolph, Jr.
- 1998 *Hardaway Revisited: Early Archaic Settlement in the Southeast*. University of Alabama Press, Tuscaloosa.
- 2000 Paleoindian Points in North Carolina. *Current Research in the Pleistocene* 17:15-16.
- Daniel, I. Randolph, Jr., and J. Robert Butler
- 1996 An Archaeological Survey and Petrographic Description of Rhyolite Sources in the Uwharrie Mountains, North Carolina. *Southern Indian Studies* 45:1-37.
- Daniel, I. Randolph, Jr., and Michael Wisenbaker
- 1987 *Harney Flats: A Florida Paleo-Indian Site*. Baywood Publishing, New York.
- Dibble, Harold L.
- 1987 The Interpretation of Middle Paleolithic Scraper Morphology. *American Antiquity* 52:109-117.
- Dincauze, Dena
- 1993 Fluted Points in the Eastern Forests. In *From Kostenki to Clovis: Upper Paleolithic-Paleo-Indian Adaptations*, edited by Olga Soffer and N. D. Preslov, pp. 293-310. Kluwer Academic Press, New York.
- Ellis, Christopher J.
- 1989 The Explanation of Northeastern Paleoindian Lithic Procurement Patterns. In *Eastern Paleoindian Lithic Resource Use*, edited by C. J. Ellis and J. C. Lothrop, pp. 139-164. Westview Press, Boulder, CO.
- Ellis, Christopher J., and D. Brian Dellar
- 1988 Some Distinctive Paleo-Indian Tool Types from the Lower Great Lakes Region. *Midcontinental Journal of Archaeology* 13:111-158.
- Gardner, William
- 1977 Flint Run Paleoindian Complex and Its Implications for Eastern North American Prehistory. *Annals of the New York Academy of Sciences* 288:251-63.
- 1989 Examination of Cultural Change in the Late Pleistocene and Early Holocene (circa 9200 to 6800 B.C.) In *Paleoindian Research in Virginia: A Synthesis*, edited by J. Mark Wittkofski and Theodore R. Reinhart, pp. 5-51. Special Publication 19. Archeological Society of Virginia, Richmond.
- Goodyear, Albert C.
- 1973 Archaic Hafted Spokeshaves with Graver Spurs from the Southeast. *Florida Anthropologist* 26:39-44.
- 1974 The Brand Site: A Techno-Functional Study of a Dalton Site in Northeast Arkansas. Research Series 7. Arkansas Archaeological Survey, Fayetteville.
- 1989 A Hypothesis for the Use of Cryptocrystalline Raw Materials Among Paleo-Indian Groups of North America. In *Eastern Paleoindian Lithic Resource Use*, edited by Christopher J. Ellis and Jonathon C. Lothrop, pp. 1-9. Westview Press, Boulder, CO.
- 1993 Tool Kit Entropy and Bipolar Reduction: A Study of Interassemblage Lithic Variability Among Paleo-Indian Sites in the Northeastern United States. *North American Archaeologist* 14:1-23.
- 1999 The Early Holocene Occupation of the Southeastern United States: A Geoarchaeological Summary. In *Ice Age People of North America: Environments, Origins, and Adaptations*, edited by Robson Bonnicksen and Karen L. Turnmire, pp. 432-481. Oregon State University Press, Corvallis.
- Gramly, Richard M.
- 1982 *The Vail Site: A Palaeo-Indian Encampment in Maine*. Bulletin of the Buffalo Society of Natural Sciences, vol. 30. Buffalo Society of Natural Sciences, Buffalo, NY.
- Grimes, John R., and Beth G. Grimes
- 1985 Flakeshavers: Morphometric, Functional, and Life-cycle Analyses of a Paleoindian Unifacial Tool Class. *Archaeology of Eastern North America* 13:35-58.
- Hayden, Brian
- 1979 Snap, Shatter, and Superfractures: Use Wear of Stone Skin Scrapers. In *Lithic Use-Wear Analysis*, edited by Brian Hayden, pp. 207-230. Academic Press, New York.
- 1980 Confusion in the Bipolar World: Bashed Pebbles vs. Splintered Pieces. *Lithic Technology* 9:2-7.
- 1992 Observing Prehistoric Women. In *Exploring Gender Through Archaeology*, edited by Cheryl Claassen, pp. 33-47. Prehistory Press, Madison, WI.
- Haynes, Gary
- 2002 *Early Settlement of North America: The Clovis Era*. Cambridge University Press, Cambridge.
- Keeley, Lawrence H.
- 1980 *Experimental Determination of Stone Tool Uses: A Micro-wear Analysis*. University of Chicago Press, Chicago.
- 1982 Hafting and Retooling: Effects on the Archaeological Record. *American Antiquity* 4 7:798-809.
- Kelly, Robert L.
- 1988 The Three Sides of a Biface. *American Antiquity* 47: 798-809.
- Kintigh, Keith
- 1984 Measuring Archaeological Diversity by Comparison with Simulated Assemblages. *American Antiquity* 49: 44-54.
- Kuhn, Steven L.
- 1994 A Formal Approach to the Design and Assembly of Mobile Toolkits. *American Antiquity* 59:426-442.
- MacDonald, George F.
- 1968 *Debert: A Paleo-Indian Site in Central Nova Scotia*. Anthropology Papers 16. National Museum of Man, Ottawa.

- McAvoy, Joseph M.
1992 *Nottoway River Survey: Part I: Clovis Settlement Patterns: The 30 Year Study of a Late Ice Age Hunting Culture on the Southern Interior Coastal Plain of Virginia*. Archeological Society of Virginia Special Publication 28. Dietz Press, Richmond.
- McCary, Ben
1951 A Workshop Site of Early Man in Dinwiddie County, Virginia. *American Antiquity* 17:9-17.
- Meltzer, David J.
1984 On Stone Procurement and Settlement Mobility in Eastern Fluted Point Groups. *North American Archaeologist* 6:1-24.
1988 Late Pleistocene Human Adaptations in Eastern North America. *Journal of World Prehistory* 2:1-52.
1993 Is There a Clovis Adaptation? In *From Kostenki to Clovis: Upper Paleolithic-Paleo-Indian Adaptations*, edited by Olga Soffer and N. D. Preslov, pp. 293-310. Kluwer Academic Press, New York.
- Moore, William H.
2002 The Pasquotank Site: Description and Analysis of a Paleoindian Tool Assemblage from the North Carolina Coastal Plain. Master's thesis, Department of Anthropology, East Carolina University, Greenville.
- Nelson, Margaret
1991 The Study of Technological Organization. In *Archaeological Method and Theory*, vol. 2, edited by Michael B. Schiffer, pp. 57-100. Plenum Press, New York.
- Odell, George H.
1996 Economizing Behavior and the Concept of "Curation." In *Stone Tools: Theoretical Insights into Human Prehistory*, edited by George H. Odell, pp. 51-80. Plenum Press, New York.
- Perkinson, Phil H.
1971 North Carolina Fluted Projectile Points: Survey Report Number One. *Southern Indian Studies* 23:3-40.
- Phelps, David S.
1983 Archaeology of the North Carolina Coastal Plain: Problems and Hypotheses. In *The Prehistory of North Carolina: An Archaeological Symposium*, edited by M. A. Mathis and Jeffrey J. Crow, pp. 1-52. North Carolina Division of Archives and History, Raleigh.
- Pilkey Orin, H., William J. Neal, Stanley R. Riggs, Craig A. Webb, David M. Bush, Deborah F. Pilkey, Jane Bullock, and Brian A. Cowan
1998 *The North Carolina Shore and Its Barrier Islands*. Duke University Press, Durham, NC.
- Randall, Asa R.
2001 Untangling Late Paleoindian and Early Side-notched Stone Tool Assemblages at Dust Cave, AL. Paper presented at the 58th Annual Meeting of the Southeastern Archaeological Conference, Chattanooga, TN.
- Rule, Pamela, and June Evans
1985 The Relationship of Morphological Variation to Hafting Techniques among Paleoindian end scrapers at the Shawnee Minisink Site. In *Shawnee Minisink: A Stratified Paleoindian-Archaic Site in the Upper Delaware Valley of Pennsylvania*, edited by Charles W. McNett, Jr., pp. 211-220. Academic Press, Orlando, FL.
- Shott, Michael J.
1989 Bipolar Industries: Ethnographic Evidence and Archaeological Implications. *North American Archaeologist* 10:1-24.
1993 *The Leavitt Site: A Parkhill Phase Paleo-Indian Occupation in Central Michigan*. Memoirs 25. University of Michigan Museum of Anthropology. Ann Arbor.
- 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 25. Research Laboratories of Archaeology, University of North Carolina at Chapel Hill.
- Torrence, Robin
1983 Time Budgeting and Hunter-Gatherer Technology. In *Hunter-Gatherer Economy in Prehistory*, edited by Geoff Bailey, pp. 11-22. Cambridge University Press, Cambridge.
- Traver, Jerome D.
1964 The Pasquotank Site, North Carolina's Easternmost Paleo Site. *Chesapeake* 2:1:15-19.
- Walthall, John A., and George R. Holley
1997 Mobility and Hunter-Gatherer Toolkit Design: Analysis of a Dalton Lithic Cache. *Southeastern Archaeology* 16: 152-162.