ARTIFACT ANALYSIS

Artifact analysis attempted to: 1) identify temporally diagnostic artifacts; 2) describe the composition of the assemblage in functional and stylistic terms; 3) assess variation in the materials used for artifact manufacture; and 4) evaluate assemblage composition in a regional context as a window into patterns of group movement, exchange, and interaction. Artifacts were classified by relative time period, method of manufacture, and function. In addition, all artifacts were weighed and the maximum size was recorded. Appendix C presents the artifact inventory.

Projectile Points

In pre-ceramic contexts, projectile points often represent the sole artifact category that exhibits distinctive stylistic variation. Projectile points included hafted bifaces and other late-stage biface fragments that resembled projectile points. Stemmed points dominated the assemblage, which included a single corner-notched point. Typological classification relied on standard reference sources used in the Middle Atlantic Region (Broyles 1971; Coe 1964; Justice 1995; Ritchie 1971; Stephenson 1963) as well as on-line information posted by Delaware's Historic Preservation Office (2013) and the Maryland Archaeological Conservation Lab (2012).

While points undoubtedly vary stylistically and functionally, the identification of temporal variation in generalized point form often overwhelms the interpretation of other attributes of points. Not all styles vary temporally, and, moreover, style responds to a range of social, ecological, and technological concerns. Nevertheless, classification of points by reference to established types provides a baseline for additional analysis, and provides clues to the probable date of occupation. Because sharpening often alters blade morphology, typological classification relies heavily on the size and shape of the hafting element. Point types recognized in the assemblage included Lamoka, Teardrop, and Bare Island points. A number of points could be classified only as stemmed.

Other Bifacial, Unifacial, and Ground-Stone Tools

Five bifaces unearthed during the Warwick Site excavation lacked halfting elements (Figure 26, p. 44). Using Callahan's (1979) terminology, four were classified as Stage 2 bifaces, one as a Stage 6 biface. Multi-directional, broad, deep flake scars that appeared to result from hard-hammer percussion characterized the early stage bifaces. Cortex, which appeared on one or more faces of the tools, extended across 50 to 100 percent of any given face. Edges were rough, with minimal shaping. Bipolar reduction appears to have characterized the initial stages of cobble reduction and tool production, though few bipolar flakes were identified in the debitage assemblage. The Stage 6 biface lacked cortex, and possessed trimmed and shaped edges; no remnants of bipolar reduction, had any existed, remained. The smaller flake scars likely resulted from a combination of soft-hammer percussion and pressure flaking.

Figure 26: Photograph of Early and Late Stage Bifaces and Preforms Recovered from the Phase I to III Excavation of the Warwick Site.

Callahan (1979), based on experimental replication of fluted points, noted that width-thickness ratios increased during point manufacture. Ratios progressed from no more than 2.0 in Stage 2 bifaces, which represent the initial shaping of the blank, to roughly 10.0 for the completed point (Callahan 1979:18). Consequently, width-thickness ratios often serve as a measure of reduction stage. It appears, however, that a host of factors, including the size and shape of available lithic material and the dimensions of the completed tool, affect the results. The width-thickness ratio of the Stage 6 biface equaled 2.71, somewhat higher than the Stage 2 bifaces (Table 7, p, 45), though well below the expected values for Stage 3 through Stage 6 bifaces (Callahan 1979:18). Moreover, the width-thickness ratios of points, by definition Stage 6 bifaces, and Stage 2 bifaces overlapped. The width-thickness ratio of 26 complete and broken bifaces recovered from the Warwick Site ranged from 1.57 to 3.55, with both the ends of the range from Lamoka Points. Mean width-thickness ratio of points equaled 2.34+/-0.42; the median value was 2.30. Petraglia et al. (1998) obtained similar results from the analysis of early and late-stage bifaces recovered from Area 1 at the Lums Pond Site, which resembled the Warwick Site in many respects. Overlapping width-thickness ratios, Petraglia et al. (1998:351), suggest:

> may signal a problem with the paradigm (that is, relative thickness may not be as closely related to reduction stage as supposed), or it may have been related to raw material characteristics (although raw material types were evenly distributed within the width:thickness ranges). More likely, the finding indicated that the bifaces recovered from the Area 1 workshop were manufacturing rejects, discarded because they were too thick and proportionally too narrow to successfully thin further.

The Stage 2 bifaces from the Warwick Site had been manufactured from chert and jasper, while the point sample included quartz and quartzite as well as cryptocrystalline materials. Breaking down the data into cryptocrystalline versus other materials does not change the result, suggesting that lithic material alone does not produce the result.

Completed points appear unlikely to represent manufacturing rejects, ruling out the inference that the points were discarded because flaws prevented further reduction. Comparison of the early stage bifaces from the Warwick and Lums Pond Sites with the points from the Warwick Site suggests that Callahan's observation, if not the specific values associated with each stage, may hold for aggregate data. The average width-thickness ratio of completed points (2.34+/-0.42), or Stage 6 bifaces in Callahan's (1979) terms, falls below that of early stage bifaces (2.87+/-1.87; p=0.12); nevertheless, thickness represents only one of a number of variables required to assess production stage. Factors like blank size and shape likely influence potential variation in width-thickness ratio.

Table 2: Dimensions of Stage 2 Bifaces Illustrated in Figure 32.

Biface	Material	Length	Width	Thickness	Width/Thickness
Stage 2	Jasper	45.0	28.5	13.6	2.1
Stage 2	Jasper	32.5	19.0	9.9	1.92
Stage 2	Jasper	40.9	30.5	16.0	1.91
Stage 2	Chert	13.7	11.4	4.2	2.71

The Warwick Site assemblage includes three additional tools. The steep edge angle of one jasper tool recovered during the Phase III work suggests use as a scraper; the tool had been manufactured using bipolar reduction. Extensive flake scars marked the dorsal surface, while thinning scars existed on the edges of the ventral surface. A second tool recovered during the Phase II work may have been used as a scraper. Recovery of only two tools possibly used as scrapers indicates that hide-processing was not a major activity at the Warwick Site. In addition, a hammerstone fragment was recovered during the Phase II work (Figure 27, p. 45).

Figure 27: Hammerstone, Possible Hafted Scraper (top), and Scraper (bottom) Phase I to III Excavation the Warwick Site.

Lamoka

Fifteen projectile points unearthed during the Phase I-III excavation of the Warwick Site were classified as Lamoka Points (Figure 28). A diagnostic attribute of Ritchie's (1965) Lamoka Complex, both the precise temporal position of Lamoka Points and the distinctiveness of the point have been questioned. Ritchie (1971:29) assigned the Lamoka Point to the Late Archaic Period, but noted that manufacture of the type continued into Middle Woodland times in some areas. Dates consistent with the Late Archaic to Middle Woodland range noted by Ritchie exist; most radiocarbon dates, however, fall between approximately 3000 and 5000 B.P., the Late Archaic Period (Figure 29 and Table 3, p. 47). Unfortunately, as Custer (1989:147–149) has pointed out, medium-sized, stemmed forms similar to the Lamoka types occur over a much longer period of time, and therefore often require additional stratigraphic or contextual information to confidently assign the points to a specific time period.

Figure 28: Lamoka Points Recovered from the Phase I to III Excavation of the Warwick Site.

Lamoka Points studied by Ritchie (1971:29) ranged from less than 25.4 to 63.5 millimeters (1.0 to 2.5 in), with the majority between 31.8 and 44.5 millimeters (1.25 and 1.75 in). Attributes included triangular blades with straight to excurvate edges, biconvex or median ridged cross sections, and a straight, roughly rectangular hafting element. Many were manufactured from pebbles or flakes, leaving a broad, unmodified surface on the base. Ritchie (1971:29) considered the "thick, 'unfinished' condition of the base" the "prime diagnostic feature of the Lamoka point wherever found."

At the Warwick Site, the eight complete Lamoka Points and those missing less than 1 millimeter (0.04 in) from the tip averaged 32.9+/-3.5 millimeters (1.3+/-0.1 in) in length; measurements fell between 27.7 and 38.0 millimeters (1.1 and 1.4 in). Width, which ranged from 15.9 to 17.9 millimeters (0.6 to 0.7 in), averaged 16.9+/-0.9 millimeters (0.7+/-0.04 in). Mean point thickness equaled 7.0+/-1.1 millimeters (0.3+/-0.04 in); thickness measurements ranged from 4.7 to 8.1 millimeters (0.2 to 0.3 in).

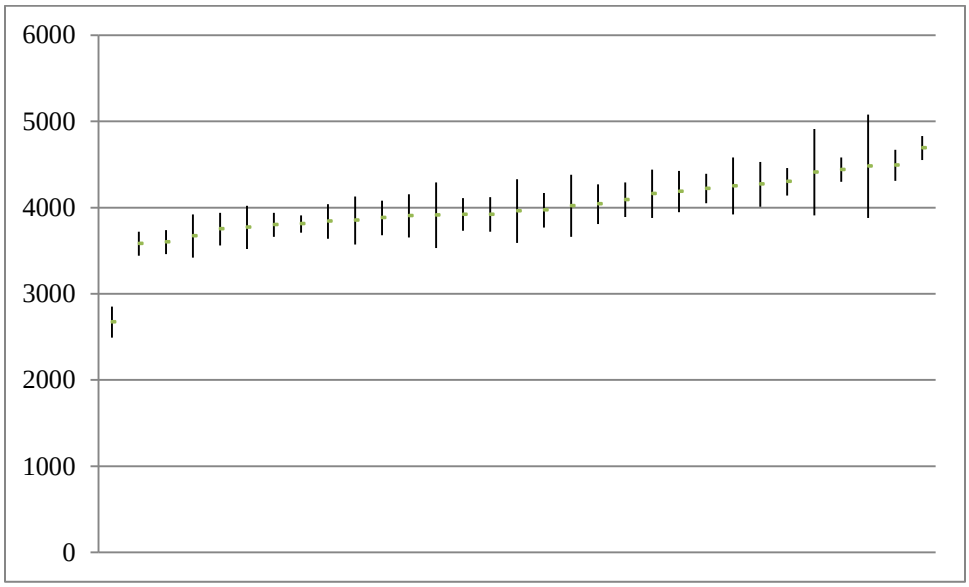

Figure 29: Two-Sigma Range and Midpoint of Radiocarbon Dates B.P. Associated with Lamoka Points (Inashima 2008).

Bare Island

Kinsey (1959) initially described the Bare Island type; more widely cited descriptions were published by Ritchie (1971), and Stephenson (1963). Medium to large, finely flaked, symmetrical points with straight-stemmed, square-to-rectangular bases and a parallel-sided blade were classified as the Bare Island type. Evidence of grinding often appears on the stem. Bare Island points share a number of attributes with the Poplar Island, Holmes, and smaller stemmed types (Ritchie 1971:14, 132; Inashima 2008:215). The rounded shoulders distinguish Poplar Island specimens from Bare Island points, which are characteristically "crisp," though "slightly rounded and tapered but not conspicuously so" (Ritchie 1971:14–15).

Ritchie (1971:15) suggested a Late Archaic age for the Bare Island and Poplar Island types; Potter (1982:303) and Waselkov (1982:223, 276) reported Terminal Archaic radiocarbon assays associated with Holmes points at the Plum Nelly (44NB128) and White Oak Point (44WM119) Sites in coastal Virginia. Radiocarbon dates associated with the Bare Island, Holmes, and Poplar Island types range from approximately 5000 to 2400 B.P. The four dates associated with Bare Island points occur near the early end of the range (Table 4, p. 49).

Table 3: Radiocarbon Dates Associated with Lamoka Points (Inashima 2008).

Point	RCBP	SD	C14 ID	Site	Site NamePoint
Lamoka	2670	90	B8810	7NCF18	Lums Pond
Lamoka	3580	70	B19277	44RU14	Daugherty's Cave
Lamoka	3600	70	B19278	44RU14	Daugherty's Cave
Lamoka	3670	125	DIC644		Kuhr No. 1
Lamoka	3750	95	I6369		Fortin Locus 1
Lamoka	3770	125	DIC88		Kuhr No. 2
Lamoka	3800	70	B19279	44RU14	Daugherty's Cave
Lamoka	3810	50			Potts
Lamoka	3840	100	I6567		Fortin Locus 1
Lamoka	3850	40	Y2610		McCulley No. 1
Lamoka	3880	100	I6566		Fortin Locus 1
Lamoka	3905	125	I6734		Kuhr No. 2
Lamoka	3910	190	DIC640		Kuhr No. 1
Lamoka	3920	95	DIC264		Mattice No. 2
Lamoka	3920	100	DIC134		Mattice No. 2
Lamoka	3960	185	DIC110		Enck No. 2
Lamoka	3970	100	I6568		Fortin Locus 1
Lamoka	4020	180	B19318	36BU23	Lower Black's Eddy
Lamoka	4040	115	I3730		Susquehanna
Lamoka	4090	100	Y2347		Castle Gardens
Lamoka	4160	140	Y1536		Sylvan Lake
Lamoka	4185	120	I7098		Fortin Locus 1
Lamoka	4220	85	DIC280		Mattice No. 2
Lamoka	4250	165	DIC116		Kuhr No. 1
Lamoka	4270	130	QC1006		Enck No. 2
Lamoka	4300	80	B19280	44RU14	Daugherty's Cave
Lamoka	4410	250	M912		Lamoka Lake
Lamoka	4440	70	B80185		Newtown Sewer
Lamoka	4480	300	M911		Lamoka Lake
Lamoka	4490	90	DIC202		Mattice No. 2
Lamoka	4690	70	B19281	44RU14	Daugherty's Cave

A single Bare Island point was recovered during the Phase III excavation of TU 45 (N1995/E1999). The point, with a broken tip, had been manufactured of ferruginous quartzite (or ironstone). Despite the missing tip, this was the largest biface in the Warwick Site assemblage. Point length equaled 75.7 millimeters (3.0 in), point width was 27.1 millimeters (1.1 in), and point thickness measured 13.5 millimeters (0.5 in). The unfinished base was similar to the bases of many Lamoka points in the Warwick Site assemblage. Nevertheless, the rectangular base, parallel-sided blade, and size recommended classification as the Bare Island type (Figure 30, p. 49).

Table 4: Radiocarbon Dates Associated with Bare Island and Related Types (Inashima 2008).

Point	RCBP	SD	C14 ID	Site	Site Name
Poplar Island	2470	50	Beta-100753	7NC-G-151	
Poplar Island	2720	90	Beta-88104	7NC-F-18	
Holmes	3500	75	DIC-1771	44WM119	
Bare Island	3600	70	Beta-10624	44MA92	
Holmes	3790	170	Beta-6702	44LD284	
Bare Island	3800	180	M-1907	36HU1	Sheep Rock Shelter
Poplar Island	3830	90	Beta-43291	28GL111	
Holmes	3905	95	SI-4229	44NB128	Plum Nelly
Poplar Island	3920	95	I-6598	Harry's Farm	
Holmes	4105	85	SI-4228	44NB128	Plum Nelly
Bare Island	4160	140	Y-1536	Sylvan Lake	Sylvan Lake
Bare Island	4300	180	M-1906	36HU1	Sheep Rock Shelter
Bare Island	4920	90	Beta-14431	44LD250	

Figure 30: Bare Island, Teardrop, and Stemmed Bifaces Recovered from the Phase I to III Excavation of the Warwick Site.

Teardrop

Ovoid-to lozenge-shaped small bifaces with convex or rounded bases have been classified as the Rossville (Ritchie 1971) and Piscataway (Stephenson 1963) type or classified more generally as teardrop points (Mounier and Martin 1994) types. Ritchie (1971:46) described Rossville Points as thick, lozenge-shaped, medium-sized, contracting stemmed bifaces. In Ritchie's (1971) sample, length ranged from approximately 31.8 to 63.5 millimeters (1.25 to 2.5 in); thickness fell between 6.4 and 11.2 millimeters (0.25 and 0.44 in).

Piscataway Points, as defined by Stephenson (1963), exhibit a narrow contracting stem that terminates in a rounded or pointed base and a blade that resembles an isosceles triangle with straight to slightly convex edges. Stephenson (1963:146–147), who also classified similar points as the Rossville type, recognized considerable overlap in the size and morphology of the types. Point length ranged from 29 to 49 millimeters (1.1 to 1.9 in), with a mean of 37 (1.4 in). The mean width of 14 millimeters (0.5 in) falls near the midpoint of the 10 to 21 mm (0.4 to 0.8 in) range.

Unlike Stephenson (1963), Mounier and Martin (1994) classified all similar points as teardrop forms. Based on C-14 assays from the Woodbury Annex Sites (28GL5 and 28GL148) in New Jersey, Mounier and Martin (1994:132) argue that "the occupation of the teardrop-related loci [at the Woodbury Annex Sites] can be dated to the first and second millennium B.C." (circa 4000–2000 B.P.). Nevertheless, manufacture of teardrop points, the authors estimate, occurred primarily between 3000 and 2000 B.P. in New Jersey (Mounier and Martin 1994:136). Radiocarbon assays, however, range in age from 4150+/-50 to 1320+/-70 radiocarbon years B.P. (

Table 5, p. 51).

The Warwick assemblage included single teardrop point recovered from TU 1 during the Phase I fieldwork (N2000/E2000). The point, manufactured from jasper, was 35.7 millimeters (1.4 in) long by 14.8 millimeters (0.6 in) wide. The maximum thickness of the point equaled 8.1 millimeters (0.3 in). The point was complete, with the contracting stem characteristic of the types (see Figure 30, p. 49). .

Discussion

Temporally diagnostic projectile points constitute the primary basis for estimating the date range bounding the prehistoric occupation of the Warwick Site. Yet, for at least 40 years Middle Atlantic archaeologists have lamented the imprecision inherent in the identification of distinctively different, temporally diagnostic types of stemmed and corner-notched forms similar to those unearthed during the Warwick Site excavations (Kinsey 1972:367; Custer 1996:167–180). Unlike mass-produced items, variation among knappers and over the use-life of any given tool hinders identification individual types. Therefore, point types recognized in the Middle Atlantic region likely represent varied forms produced over the life of the tool (e.g., Barber and Barfield 1984; Hoffman 1985). Morphology provides information about the extent of reworking evident on the tool.

Table 5: Radiocarbon Dates Associated with Teardrop Points (Inashima 2008).

Type	RYBP	SD	C14 ID	Site	Site Name
Piscataway	1320	70	B98358	44SP220	Hoard's Mill
Piscataway	1440	90	B31880	44FX1561	Neha
Rossville	1570	120	B54857	44HN204	
Rossville	1580	70	B13005	44PA174	Meadow School Road
Rossville	1600	130	GX9705	19BN390	
Rossville	1880	120	Y2475	36PI13A	Faucett
Rossville	2050	80	Y1812		Frank Vincent
Rossville	2050	80	Y1854		Frank Vincent
Rossville	2050	135	I5542	36PI13A	Faucett
Rossville	2070	80	GX16803		Grouse Bluff
Piscataway	2405	120	?	18PR131	Falcon's Landing
Rossville	2405	120	?	18PR131	Falcon's Landing
Rossville	2430	80	Y2590		Miller Field
Rossville	2450	15	B19322	36BU23	Lower Black's Eddy
Rossville	2460	60	B7764		Oak Island
Rossville	2540	70	B26602	36BU23	Lower Black's Eddy
Rossville	2870	160	B54855	44HN204	
Rossville	3100	70	B80925	44KW81	
Piscataway	4060	80	I39358	44FX2076	Lorton Town Center
Piscataway	4150	50	B39301		Magnolia

Symmetry, potentially enhances both projectile function and an aesthetic appreciation common to many, if not all, cultures (e.g., Cotterell and Kamminga 1992; Wiessner 1983). Building upon these insights, Knepper et al. (2004:61–63) "examine the information that artifact shape can reveal about tool function and long-term use." Tool rejuvenation, often conducted expediently, may reduce symmetry. As a consequence, an assessment of tool symmetry potentially informs the analysis of use-life stage.

Rejuvination of a hafted tool typically alters the blade to a far greater degree than the hafting element (Hoffman 1985:573–583; Knepper et al. 2004:63). In addition to point length, shoulder width, and blade thickness, maximum haft length, width, and thickness were measured. Blade length equaled point length minus haft length. In addition, with the shoulder aligned along the east-west (i.e., 90–270 degree) axis and the point centered on the north-south (0–180 degree) axis, measurements were taken from the center of the intersection of the haft and shoulder to the edge of the blade. Blade measurements, following Hoffman's (1985:588) method and nomenclature, were taken at 30 (A1), 330 (A2), 70 (C1), and 290 (C2) degrees. The A1:A2 and C1:C2 ratios provide an estimate of blade symmetry and allow measurement of points with fractures above a line bisecting the blade from the 30 and 330 degree edges.

For a symmetrical point, A1 equals A2 and C1 equals C2. Theoretically, complete asymmetry produce values of zero for the missing half; practically, precisely how the analyst centers the tip to haft axis may cause the value to rise slightly above zero. Dividing the difference of the two measurements (e.g., A1-A2) by the sum of the same two measurements (e.g., A1+A2) an estimate of the extent of divergence (D_S) from symmetry that ranges from zero for symmetrical points to one for completely asymmetrical forms:

$$D_S = \frac{X_{A/C} - X_{A/C}}{X_{A/C} + X_{A/C}}$$

The sum of the two Ds values (i.e., the Ds for the A1 and A2 values plus the Ds for the C1 and C2 values) ranges from zero to two; half of that sum ranges from zero for a symmetrical point to one for a completely assymetrycial point. Measurements were taken on all complete points, broken points with fractures above the A1-A2 line, one late-stage stemmed biface, and two reworked points. Values ranged from zero to over 0.2. Figure 31 (p. 53) illustrates the points corresponding to the data in Figure 32 (p. 53). Plotting the values produces two breaks, at 0.1 and 0.2. The majority of the complete and nearly complete points, it appears, were not extensively reworked.

Functional variation also influences artifact attributes. Knappers balance "penetration, haft security, durability, wound size, multiple use, projection distance, projection speed, ease of transport, and ease of recovery" when designing weapons" (Nelson 1997:377). Projectile width correlates negatively with sharpness, penetration, and, as a consequence, wound size. Thickness, or cross-section size, increases wound size, enhances durability, and lengthens use life. As size and weight increase, projection distance and speed, as well as portability, decreases. Haft form influences the security of the haft and contributes to breakage (Nelson 1997:377–380).

Stone spear and arrow tips appear more lethal than alternative materials. As a consequence, stone points typically serve as spearheads for hunting large game and warfare. The ethnographic association with large game, Ellis (1997:63) observes "is so strong that in prehistoric cases one can almost always assume that stone points were used in large animal hunting." Ethnographically, fishing with spears, darts, and arrows and hunting small game generally relies on organic tips or points rather than stone (Ellis 1997:50). Organic points, more likely to float, were used to impale waterfowl, small sea mammals, and fish. Throwing sticks, traps, and, when available, organic-tipped arrows were used to capture small game (Ellis 1997:46).

The return from hunting large game, Ellis (1997:53) suggests, offset the high production and maintenance cost of stone points. The sharp edge makes stone points lethal, which allows use of a lighter spear shaft, as well as suited for functions like cutting, scraping, and sawing. Consequently, hafted stone points enhance both portability and rapid shifts between different tasks, and a lighter shaft improves throwing and firing range (Ellis 1997:63–65). Thus, even projectiles likely served a range of tasks.

Figure 31: Selected Points Arranged from Symmetrical (Top Left) to Asymmetrical (Bottom right), Corresponding to the Measurements from 0.0 to 0.28 Plotted in Figure 25.

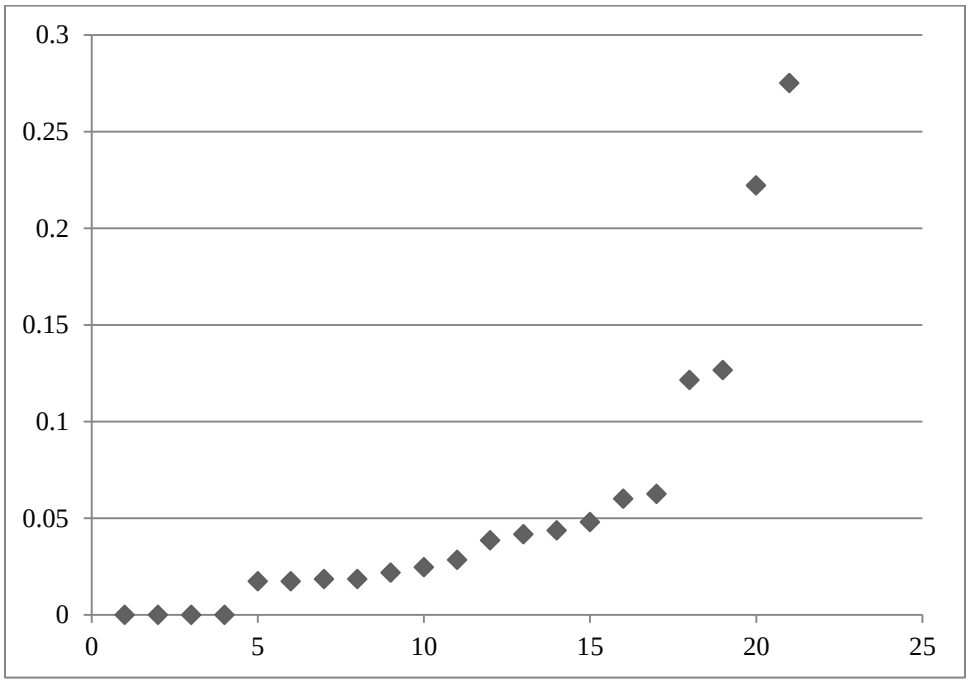

Figure 32: Overall Symmetry/Asymmetry Measurements.

Custer (1996:176–177; cf. also 1991) argues that

> use wear and breakage patterns for stemmed points and broadspears… indicate that stemmed points were more likely to have been used as projectile points, and broadspears were more likely to have been used as knives or generalized cutting tools. Because they have different functions, it is not unreasonable to presume that the two tool forms were used and discarded at different locations….[Therefore], a 'pure' stemmed point assemblage from…[circa 4500–3500 B.P.)…could be created if only stemmed projectile points were discarded at a special-function site.

Broadspear width exceeds the optimal size range for spearheads, a range of roughly 25 to 32 millimeters (1.0 to 1.2 in); more broadly, Custer (1991) uses 30 millimeters (1.2 in) as the cutoff point separating narrow projectiles from broad tools typically used as knives or for other functions. The broadest point in the Warwick Site assemblage, the ferruginous quartzite Bare Island, was 27.1 millimeters wide, and many were well below the 25 millimeter recommended minimum size of modern arrows reported by Custer (1996).

Distal impact fractures refer to breaks caused by the tip of the point striking an animal or object. Distal fractures, "produced from stresses received by the edges and faces of the point tip," occur primarily on the distal third of the point. Transverse fractures, on the other hand, "result from staggered stresses acting along the blade faces from opposite directions" (Truncer 1988:64). The angle of the break may provide additional information about the orientation of use, though the tendency of stone tools to fracture along weak points in the stone limits inferences based on solely on fracture patterns.

In Custer's (1991:60) sample of 1,165 broadspears from the Middle Atlantic Region, 32 percent exhibited transverse or oblique fractures; impact fractures were observed on six percent of the points. In contrast, 45 percent of narrow-bladed stemmed points and 55 percent of triangular points exhibited impact fractures. Transverse fractures appeared on 12 percent of narrow-bladed stemmed points and 10 percent of triangles in the sample. Most archaeologists consider triangular forms points for arrows, suggesting that transverse and impact fractures accurately identify the most common use of stone points in the aggregate (Custer 1991:69). Of course, the range of factors that caused any single break on a particular point was probably complex. More generally, Custer (1991:69) concludes that "as width increases so does frequency of transverse fractures. In contrast, as width decreases so does frequency of transverse fractures. The slope of the line for impact fractures is steeper than that for transverse fractures indicating that point width is a more severe constraint on projectile use than on knife use."

Breaks near the distal (tip) and proximal (haft) ends of the point are easily recognized on incomplete specimens. The identification of medial fractures, in constrast, may be overly subjective. Thus, the broken tip of Bare Island point represents a distal fracture. For many of the smaller stemmed points, however, classification is less simple. Although the size of complete and broken points perhaps differed, the sample of complete points provides a non-subjective basis for classification of fracture location. Regression equations identified point thickness and haft thickness and the best predictions of point

length (R^2=0.36, p=.03). Thick cortex adheres to the stem and blade of the high outlier (Figure 33). Therefore, the high outlier, perhaps a late stage reject, was removed, raising both the R^2 value (0.48) and significance (p=0.01) of the resulting equation. Removing the low outlier (4.7 mm [0.2 in]) improved the R^2 value, but no non-statistical logic supported elimination of the point. Moreover, the 48 percent of the variation in point length explained by point thickness appears sufficient, in conjunction with visual inspection, to classify fractures as distal, medial, or proximal breaks (Table 6, p. 56; Figure 34, p. 57;).

Distal breaks constitute 63 percent (10 of 16) of the broken points; three fractures were classified as medial and three as proximal. Of the ten distal fractures, eight were classified as impact fractures, roughly half the entire sample. Moreover, the length of two of the fragments in the medial category was nearly two-thirds of the projected length of the point, suggesting that either may have broken within the distal third of the points. The points, therefore, likely served primarily as hafted projectiles. Nevertheless, use for cutting, sawing, and other actions that introduced stresses along the ventral and dorsal faces of the blade probably occurred regularly; three of the four biface fragments with multiple fracture orientations were classified as the distal end of points, suggesting multiple, not-necessarily concurrent, uses. Flake scars across the width of one hafted biface proximal fragment may identify a broken stemmed point reworked to form a hafted scraper.

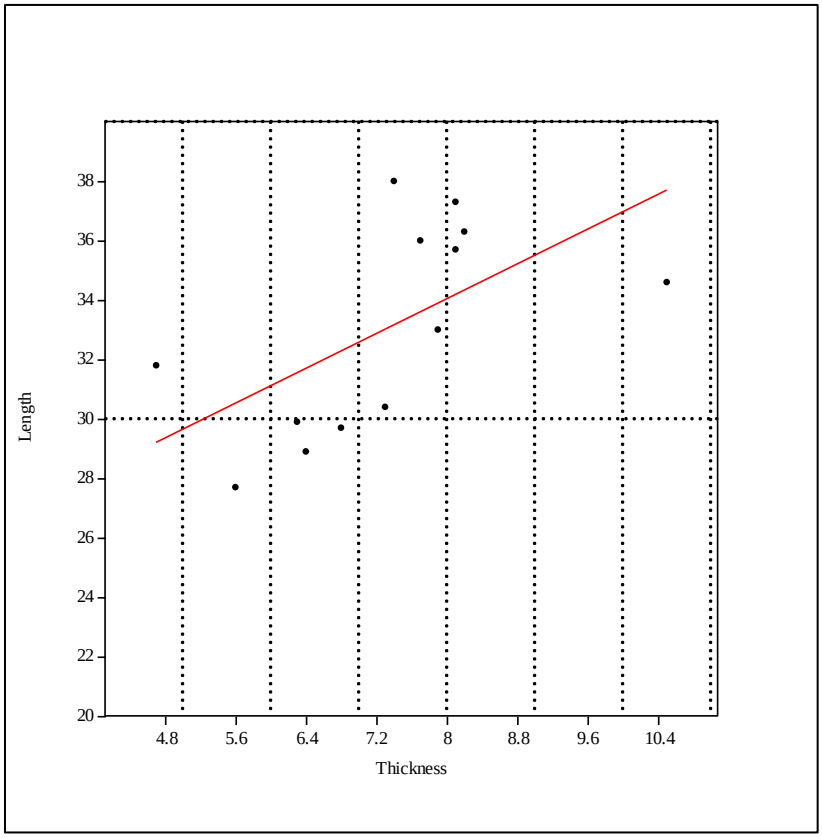

Figure 33: Scattergram of Point Thickness and Length for Complete and Near Complete Stemmed Points from the Warwick Site.

Table 6: Estimated Size and Fracture Data for Broken Late-Stage Bifaces from the Warwick Site
(Estimated Size = 17.01 + (2.25* [Thickness]).

North	East	Type	Material	Length	Projected	Length/ Projected Size	Location	Orientation	Interpretation
1994	1999	Biface Tip	Chert	13.7	NA	NA	Distal	Perpendicular	Impact Fracture
1994	2000	Corner Notched	Jasper	16.3	NA	NA	Proximal	Multiple	Multiple
1994	2001	Lamoka	Quartz	36.0	40.9	88.02%	Distal	Oblique	Impact Fracture
1994	2002	Lamoka	Jasper	21.9	33.2	65.96%	Medial	Perpendicular	Torque Fracture
1994	2002	Lamoka	Quartz	29.2	36.1	80.89%	Distal	Oblique	Impact Fracture
1995	1999	Bare Island	Quartzite	75.7	NA	NA	Distal	Perpendicular	Impact Fracture
1995	2001	Stemmed	Jasper	19.5	NA	NA	Proximal	Flaked Perpendicular	Re-purposed Tool; Possible Scraper
1995	2002	Lamoka	Jasper	26.2	32.3	81.11%	Distal	Multiple	Multiple
1995	2003	Lamoka	Jasper	22.6	32.5	69.54%	Medial	Oblique	Torque Fracture
1998	2000	Lamoka	Chert	27.5	31.2	88.14%	Distal	Multiple	Impact Fracture
1998	2001	Stemmed	Quartz	22.3	31.4	71.02%	Distal	Multiple	Multiple
1999	1998	Biface Tip	Quartz	24.2	37.0	65.41%	Medial	Perpendicular	Torque Fracture
2000	1998	Lamoka	Quartz	36.0	37.0	97.30%	Distal	Perpendicular	Impact Fracture
2000	2001	Stemmed	Chert	22.1	31.2	70.83%	Distal	Multiple	Multiple
2000	2002	Lamoka	Jasper	31.8	32.8	96.95%	Distal	Oblique	Impact Fracture
2001	2000	Lamoka	Jasper	30.4	31.4	96.82%	Distal	Perpendicular	Impact Fracture

Figure 34: Point Fracture Pattern: From Left to Right: Proximal Fracture, Medial Fracture, and Multiple Fractures.

Use-Wear Analysis

Distinct tasks often leave identifiable traces on the edges and surfaces of tools. Therefore, examination of stone tools under a microscope may provide insight into the types of tasks undertaken using different tools (Odell 2001:50–56). Low-powered (10X–60X) examination of use-wear on projectile points and other tools attempted to evaluate extent of use prior to deposition, identify hafted tools, and determine the range of tasks undertaken using different types of tools. In addition, several large, unmodified flakes were examined for evidence of use as tools. The dorsal and ventral surfaces of each tool were examined. The analyst recorded the presence or absence of use wear, the type and extent of use wear, and the location of the wear on each tool. Specific traces of use wear recorded include polish, striations, chipping, and microscopic flake scars (Figure 35 to Figure 38, pp. 58–60). Use wear was recorded for: 26 hafted bifaces and late-stage blade fragments; three Stage 2 bifaces; one extensively modified flake that exhibited the steep edge angle characteristic of tools interpreted as scrapers; one large modified flake fragment; and one large flake with no macroscopic evidence of edge modification or use as a tool. In addition, examination of several small flakes suggested that intermittent edge damage potentially resulted from a range of uses and post-depositional processes.

Damaged edges were identified the haft on many stemmed points, consistent with use as hafted projectiles. The hafting element regularly extended over the lowermost portion of the blade. Points also exhibited significant amounts of edge damage and, in some cases, striations. In general, broken points exhibited greater edge and surface damage than complete points, implying a longer use life for broken tools. The combination of

striations and edge damage is consistent with scraping or sawing. Like fracture patterns, the use-wear data point to use of projectile points for a range tasks beyond firing.

One broken stemmed point appeared reworked to create an edge across the width of the point. Near-continuous damaged edges identified the hafting element. Microflakes occurred on the upper edges of the blade. Rounding and polish on the distal edge perhaps indicated use on a high-silica material, like plants (e.g., Clemente and Gibaja 1998).

Early stage bifaces exhibited minimal edge damage, similar to that observed on small flakes, and few striations or polished areas appeared. The early stage bifaces apparently were seldom used in that condition. Edge damage was observed on a large flake, implying short-term use as an expedient tool. More extensive microflaking, edge damage, and a few striations appeared on a bipolar flake with a steep edge angle, indications of scraping hard materials.

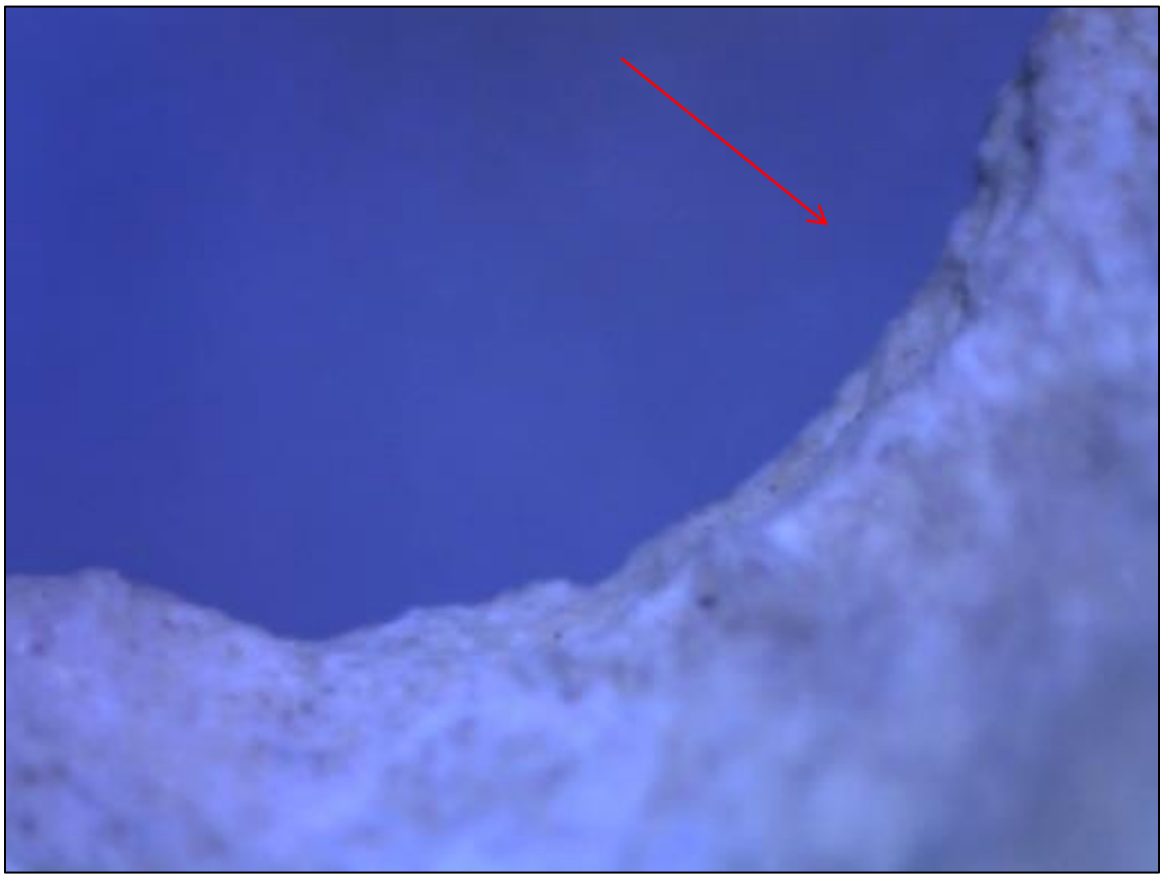

Figure 35: Example of Chipped Edges on the Stem of a Lamoka Point.

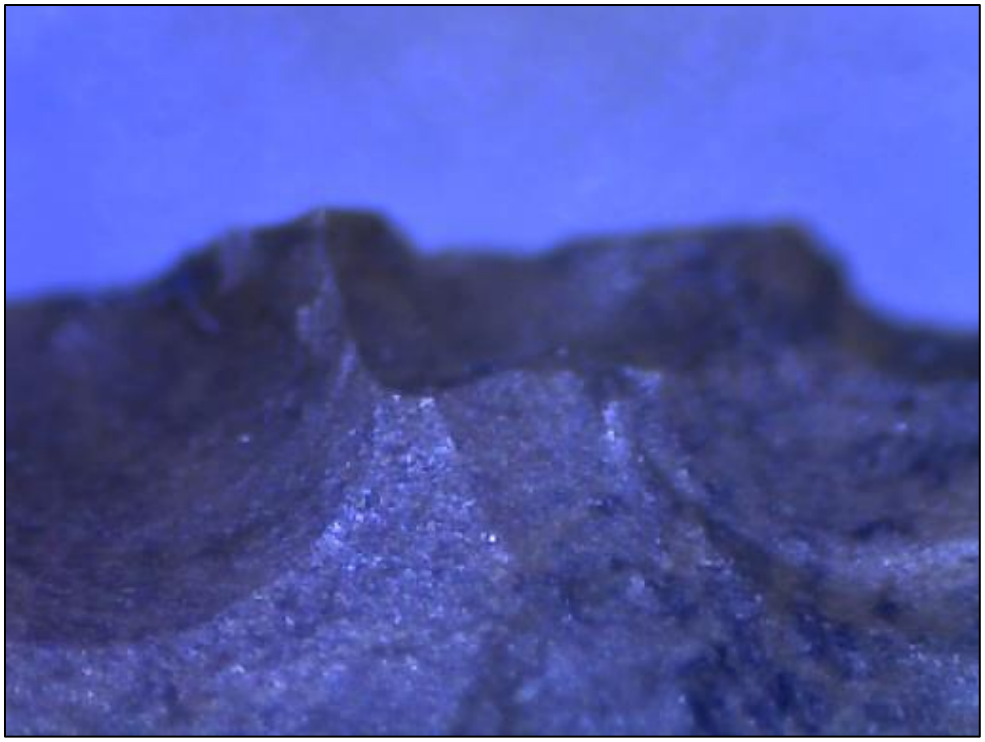

Figure 36: Example of Microscopic Flake Scars on the Edge of a Corner-Notched Point.

Figure 37: Example of Striation Near the Tip of a Lamoka Point.

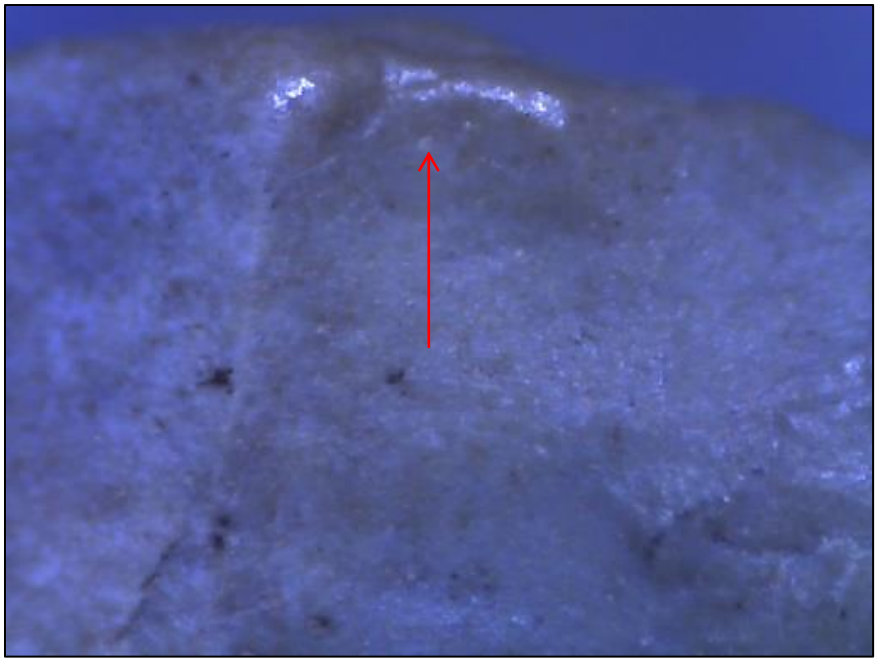

Figure 38: Example of Rounding and Polish on the Edge of a Probable Hafted Scraper.

Point Dimensions and Projectile Type

The size of the stemmed points recovered from the Warwick Site also provides information about projectile technology. Regional overviews typically locate the appearance of atl-atl technology in the Early Archaic, and both focused studies and regional overviews infer the appearance of bow-and-arrow technology from the widespread reliance on triangular points after roughly 1000 B.P. (e.g., Blitz 1988; Custer 1989; Dent 1995; Shott 1993; Tomka 2013). Odell (1998), in contrast, argued that arrows were used in North America during the Archaic, while Amick (1994) and Patterson (1994) suggest Pleistocene use of the bow-and-arrow. Shott (1997) and Thomas (1978) suggest that metric attributes distinguish arrows from darts thrown from an atl-atl. Shott's (1997:87–89) data was collected from specimens curated in museums throughout North America.

The metric attributes of Lamoka and Teardrop points unearthed during the Warwick Site excavations fall within one standard deviation of the arrow points presented by Shott in all but thickness (1997:91; Table 7, p. 61). The Bare Island point, in contrast, resembles atl-atl darts in shoulder width, but exceeds the upper end of the one standard deviation range in length, thickness, and haft thickness. Small, broad stemmed points resemble arrows in length and neck width, but exceed the one sigma range of the thickness and width values. The Bare Island point, therefore, likely represents a dart or spear point, while the Lamoka and Teardrop points perhaps tipped arrows. The functions of the small, broad stemmed points remain unclear.

Length and shoulder width represent the primary distinguishing attributes. Dart length, however, varied considerably. Moreover, reliance on length eliminates a large portion of

available samples (Shott 1997:95–98). Fortunately, shoulder width emerged "in all solutions as the most significant discriminator between dart and arrow points, to the extent that using a discriminant function alone produces similar results to the multiple variable solutions" (Shott 1997:99). Eliminating the Bare Island point and the other large quartzite stemmed biface, and lumping all 17 small, narrow stemmed points with intact shoulder widths together produces a mean value of 16.7+/-0.8, a median of 16.6, and a range of 14.7 to 18.2, very similar to the values for arrowheads. Small, narrow-bladed points, therefore, may highlight the use of arrows in the circum-Chesapeake Bay Region by at least 3000 B.P.

Alternatively, point dimensions perhaps reflect the limitations imposed by the available cobbles. The maximum dimensions of stage 2 cryptocrystalline flaked tools recovered from the Warwick Site equals 45 millimeters (1.8 in). Yet Klein et al. (1998) and Kirchen (2001) came to similar, albeit tentative, conclusions about narrow-point function based on samples of teardrop points from central Virginia and North Carolina, where cobble size dof not constrain point dimensions to the same extent, and Miller (1998:117) alludes to the possibility that triangular points recovered from Archaic contexts reflect use of the bow-and-arrow. Therefore, the possibility that people in the Chesapeake Bay region hunted with the bow and arrow prior to circa 1000 B.P. deserves consideration.

Table 7: Comparison of Points from the Phase I-III Work at the Warwick Site with Ethnographic Samples of Dart and Arrow Points (from Shott 1997).

Projectile Type	Attribute	Mean	Standard Deviation	Number
Arrowhead	Length	30.6	8.3	130
	Shoulder Width	14.4	3.4	
	Thickness	3.9	1.1	
	Neck Width	9.8	2.6	
Atl-Atl Dart	Length	51.7	14	39
	Shoulder Width	23.1	4.6	
	Thickness	5.0	1.0	
	Neck Width	15.2	3.3	
Bare Island	Length (Tip Missing)	75.7	NA	1
	Shoulder Width	27.1	NA	
	Thickness	13.5	NA	
	Neck Width	21.1	NA	
Lamoka	Length (Tip Missing)	32.9	3.5	8
	Shoulder Width	16.9	1.9	
	Thickness	7.0	1.1	
	Neck Width	11.2	1.4	
Teardrop	Length	35.7	NA	1
	Shoulder Width	14.8	NA	
	Thickness	8.1	NA	
	Neck Width	11.2	NA	
Other Small Stemmed	Length	33.5	2.8	3
	Shoulder Width	21.6	1.1	
	Thickness	8.5	1.5	
	Neck Width	11.7	1.4	
All Small Stemmed Points	Shoulder Width	16.7	0.8	17

Debitage

The near ubiquity and abundance of debitage make it a particularly informative class of lithic material. The amount of debitage recovered often allows statistically-significant analyses of the attributes and distribution of materials. In contrast, sample size often precludes detailed statistical study of other types of artifacts (Shott 1994). Moreover, collectors seldom remove debitage from sites, and curation of some types of tools skews inferences about on-site activities inferred from the frequency of bifaces, cores, and other formal tools. Debitage, unlike formal tools, typically remains on the landform after abandonment.

Debitage analysis rests primarily on patterned variation in the size and form (Shott 1994; Sullivan and Rozen 1985). Although analysts commonly record production stage as primarily, secondary, and tertiary, as occurred during the analysis of the Phase III assemblage, "the manufacture of chipped stone artifacts is more realistically viewed as a continuum rather than as a distinct set of distinct technological events" (Sullivan and Rosen 1985:755). The stage and type of tool production influences, but does not determine, debitage attributes.

The TU debitage assemblage consisted of 693 pieces of jasper, chert, quartz, and quartzite (including ferruginous quartzite/ironstone; Figure 39, p. 62). Only 43 fragments of angular debris (6 percent) were recovered during the Phase III excavation. Tertiary flakes (72 percent) dominate the Phase III assemblage, followed by secondary (18 percent) and primary (10 percent) flakes. Debitage attributes confirm the impression late-stage reduction represents the major phase of knapping at the Warwick Site.

Figure 39: Sample of Debitage Recovered from the the Phase I to III Work at the Warwick Site.

Debitage size undoubtedly reflects the size of the source material. Nevertheless, the size distribution reinforces the impression drawn from the analysis of flake stages. Broken flakes do not skew the data; rather, all categories are left-skewed, complete flakes more

so (Table 8). Quartzite, a tough material, differs slightly, perhaps reflecting the size of the tools produced. Table 9 presents the size data for complete flakes only.

Table 8: Phase I-III Measured Debitage by Size.

Material	<1 cm	1–2 cm	2–3 cm	3–4 cm	4–5 cm	5–6 cm	Total
Chert	131	75	7	1	0	0	214
Jasper	198	91	20	0	1	0	310
Orthoquartzite	0	1	1	0	0	0	2
Quartz	35	24	12	4	1	0	76
Quartzite	21	26	19	7	0	1	74
Sandstone	0	3	1	0	0	0	4
Unidentified	1	0	0	0	0	0	1
Total	386 (57%)	220 (32%)	60 (9%)	12 (2%)	2 (<1%)	1 (<1%)	681 (100%)

Table 9: Phase I-III Whole Flakes by Size.

Material	<1 cm	1–2 cm	2–3 cm	3–4 cm	4–5 cm	5–6 cm	Total
Chert	47	13	4	0	0	0	64
Jasper	55	22	4	0	0	0	81
Orthoquartzite	0	0	0	0	0	0	0
Quartz	7	3	0	1	0	0	11
Quartzite	4	6	1	3	0	1	15
Sandstone	0	0	0	0	0	0	0
Unidentified	1	0	0	0	0	0	1
Total	114 (66%)	44 (26%)	9 (5%)	4 (2%)	0 0%)	1 (1%)	172 (100%)

Cortex occurs in roughly equal amounts on the major materials, chert, jasper, quartz, and quartzite (Table 10, p. 64). Statistical comparison of the frequency of cortex by cryptocrystalline versus other materials using the Chi Square ($\chi 2$) test produces an insignificant result (Table 11, p. 64). The Phi statistic ($\chi 2/n$), useful in cases where large sample size may inflate the Chi Square result, indicates that the sample size likely inflates the significance. Since the percentage of cortex on quartz and quartzite differs little from that on cryptocrystallines, no distinction between exotic and locally available materials exists. Rather, the low frequency of cortex suggests the Warwick Site occupants exploited locally available cobbles of all types, while the predominance of chert and jasper identifies cryptocrystallines as favored materials. Phase IA fieldworkers observed cobbles in the general vicinity of the Warwick Site, though material types were not specified (Grossman-Bailey and Hayden 2009:5).

Exploitation of pebbles and small cobbles often relies on bipolar technology; attributes of Stage 2 bifaces suggested bipolar splitting of cobbles. While bipolar methods may have been used in the initial stages of cobble reduction, very few bipolar flakes were identified. The size range of the five bipolar and possible bipolar flakes extended from a low of 9.3 millimeters (0.4 in) to a high of 42 millimeters (1.6 in), a median value of 21.9 millimeters. Bipolar production tends to produce larger pieces than late-stage knapping, resulting in a size distribution of debitage closer to the normal or Gaussian distribution

(Petraglia et al. 1998:362; cf. also Patterson 1990). Thus, the dearth of bipolar flakes and the left-skewed distribution of debitage size indicate that most early stage reduction of cobbles occurred elsewhere, probably near the source of the cobbles.

Table 10: Phase I-III Cortex by Debitage Material.

Material	Number	Cortex Present (Number)	Percent of material with Cortex
Chert	214	31	14
Jasper	310	43	14
Orthoquartzite	3	2	67
Quartz	76	12	16
Quartzite (including Ferruginous)	74	12	16
Sandstone	4	1	25
Unidentified	1	0	0
Total	681	101	15

Table 11: Chi Square Test for Cortex by Cryptocrystalline and Other Materials. Expected values in parenthesis.

Material/Cortex	Present	Absent	Sum
Cryptocrystalline	74 (77.7)	450 (446.3)	524
Other	27 (23.3)	130 (133.7)	157
Sum	101	580	681
$\chi 2=0.9045$; $p = 0.3416$; $\varphi=0.0013$			

A high frequency of complete flakes, some argue, results from core-based production of flakes. Biface manufacture, in contrast, leaves behind more broken flakes (e.g., (Petraglia et al. 1998:359). Complete flakes represent 30 percent of the chert debitage (64/214), 25 percent of the jasper debitage, 20 percent of the quartzite assemblage (15/74), and 14 percent of the quartz debitage (11/76). The brittleness of quartz undoubtedly contributed to the low percentage of complete quartz flakes—"Virtually all quartz flakes shatter upon detachment, regardless of force application mode" (Bourdeau 1981:16). In combination, the left-skewed size distribution and moderately high frequency of complete flakes implies late-stage production of bifaces, sharpening existing tools, or, most likely, a combination of both processes.

Evidence of heating, primarily reddening and a glossy hue, was recognized on 145 pieces, or 21 percent of the assemblage. Jasper made up 72 percent of heat-altered debitage, followed by chert (21 percent), and quartzite (7 percent). Like the assemblage as a whole, the distribution of heat-altered debitage was left-skewed. Nearly half of interior surfaces had been altered by heat, indicating that the heating occurred after detachment from the objective piece. Post-detachment alteration occurred most commonly on quartzite, probably an indication that heat-altered quartzite, and perhaps much of the other heat-altered debitage, does not result from tool production (Table 12, p. 65). The low-frequency distribution of heat-altered lithics occurred throughout the site, apparently mirroring artifact density, as did post-detachment, heat-altered debitage (see below).

The heavy fraction of flotation samples collected from Stratum II (Ap Horizon) and Level 1 of Stratum III (B1 Horizon) in the Phase III test units was examined for microdebitage. Microdebitage was collected to evaluate the distribution of macroscopic debitage. For this reason, the discussion of microdebitage appears under intra-site spatial analysis.

Table 12: Heat-Treatment by Size Grade, Phase I-III Assemblage. Post-detachment heating appears in parentheses.

Material	<1 cm	2 cm	3 cm	4 cm	5/6 cm	Total
Chert	25 (3)	5 (3)	0	1 (1)	0	31 (7)
Jasper	71 (8)	21 (18)	5	0	0	104 (31)
Quartzite	1	6 (5)	2 (2)	1 (1)	0	10 (8)
Total	104 (72%)	32 (22%)	7 (5%)	2 (1%)	0 0%)	145 (100%)

Ground/Pecked Stone Tools

One broken sandstone hammerstone was recovered during the Phase II excavation (see Figure 27, p. 45). The hammerstone was recovered from TU 23 (N2003/E2004), near the northeastern edge of the excavation block. Nearby test units contained high densities of fire-cracked rocks; no evidence of firing was observed on the tool. Pecking and battering was evident on the end of the broken tool. The recovery of a single hammerstone, along with the dearth of bifaces and early stage debitage, indicates that very little, if any, early stage reduction of cobbles occurred on site.

Fire-Cracked Rock

Fractured cobbles lacking evidence of flake removal or use as an abrading and pounding tool that also exhibited discoloration, crazing, cracking, or multiple non-linear fracture patterns were classified as fire-cracked rock (FCR). Cooking over a fire, rings constructed to contain fires, boiling liquids with heated stone, generation of steam, and fires built for warmth, protection from predators, signaling, and to enhance ceremonial performance produce stone altered to various degrees by heat (Petraglia 2002). Given the diversity of potential causes of stone altered by heat and the varied effects on the size of the cracked fragments, weight likely represents a more accurate estimate of abundance than count.

FCR, like other artifacts, occurred within the deflated plowzone and uppermost portion of the B1 horizon; no undisturbed hearths or fired-rock pavements were identified. The FCR assemblage comprises six material types (Figure 40, p. 66; Table 13, p. 66). Nevertheless, by both count (93 percent) and weight (98 percent), quartzite and sandstone constitute the overwhelming majority of FCR at the Warwick Site. Cavallo's (1987:175–181) experiments indicate quartzite withstands repeated thermal shocks caused by reheating more readily argillaceous materials and quartz. Sandstone's reaction to fire closely resembles that of quartzite (Crandell n.d.). Yet quartz represents the third most common material in the FCR assemblage by count. Gonick (2003) determined

experimentally that quartz remained intact longer than quartzite when heated, certainly valuable for hearth construction. Nevertheless, "quartzite performed in a thermally superior manner to quartz with respect to water heating capacity" (Gonick 2003:158). Moreover, Gonick (2003:158) also noted that "quartzite typically spalled, while quartz shed small angular pieces" (cf. also Cavallo 1987:178–179). Small angular fragments appear detrimental for stone boiling, commonly believed to have been an important cooking technique during the Terminal Archaic (e.g., Klein 1997).

Figure 40: Sample of Fire-Cracked Rock Recovered from the the Phase I to III Excavation of the Warwick Site.

Table 13: Fire-Cracked Rock Recovered from Phase I-III TU Excavation at the Warwick Site.

Material	Count	Percent by Count	Weight (grams)	Percent by Weight
Argillite	1	<1	18.9	<1
Jasper	2	1	5.8	<1
Pebble Conglomerate	1	<1	47.5	<1
Quartz	8	5	46.1	1
Quartzite	117	67	3,532.4	63
Sandstone	45	26	1988.4	35
Total	174	100	5,640.0	100

Quartzite and sandstone commonly appear in hearths throughout the region. Argillite likely withstands heat as well as the, sandstone. Intentional or unintentional inclusion of jasper unsuited for tool production in fired areas may explain the use of jasper. The small size of the jasper FCR fragments, 0.6 and 5.2 grams (0.2 and 1.8 oz), supports either interpretation. Alternatively, since both fire-cracked jasper fragments were recovered outside the major cluster of FCR, misidentification may explain the jasper pieces identified as FCR. Heat-treated debitage appeared in both TU 40 and TU 61 along with the jasper identified as FCR.

Flotation

Sixty-six soil samples collected from the Warwick Site were processed at Justine McKnight's Severna Park, Maryland laboratory. Samples were collected from the plowzone (Ap horizon), designated Stratum II, and the uppermost level of the subsoil (B1 horizon), designated Stratum III, Level 1. No undisturbed cultural features were identified during the Phase III excavation. Samples were air-dried and processed using a Flote-Tech flotation system equipped with 0.325 millimeter (0.1 in) fine-fraction and 1.0 millimeter (0.4 in) coarse-fraction screens. In addition, processing separated the light fraction, which floated, from the heavy fraction, which was trapped by the screens. Both fractions were passed through a 2.0 millimeter geological sieve; the larger specimens were examined under low (10X–40X) magnification and sorted into general categories. Material from the smaller fraction, which passed through the 2.0 millimeter (0.7 in) sieve, was examined under low magnification to isolate cultivated-plant and carbonized-seed remains for further study. Appendix A provides a full explication of the process and results, which are summarized here.

Coarse sand, gravels, concretions, miscellaneous ecofacts, and microdebitage constituted the heavy fraction. The light fraction included carbonized, partially burned, and un-carbonized plant remains. Carbonized plant remains may reflect, at least in part, prehistoric activity at the Warwick Site. The 66 samples from the 33 Phase III test units yielded 15.53 grams of carbonized plant macro-remains. Wood charcoal occurred in all 66 samples, carbonized nut shells in six and carbonized seeds in 15 samples (Table 14).

Table 14: Carbonized Specimens Recovered from the Phase III Flotation Samples

Statistic	Wood Charcoal		Carbonized Nut Shells		Carbonized Seeds	
	Count	***Weight (grams)***	***Count***	***Weight (grams)***	***Count***	***Weight (grams)***
Mean	33.14	0.22	0.35	0.00	0.41	0.00
Standard Deviation	25.28	0.20	1.98	0.02	0.85	0.00
Median	29.50	0.18	0	0.00	0	0
Minimum	3	0.00	0	0.00	0	0
Maximum	138	1.00	16	0.19	3	0.02
Total	2187	15.53				
Number of Samples	66	66	66	66	66	66
Positive Samples	66	66	6	6	15	15

Charred wood occurred in every sample, a total of 2,187 fragments larger than two millimeters (0.1 in) in diameter. Wood charcoal accounted for over 93 percent of the analyzed plant carbon, by weight, with an average of 8.5 grams of wood charcoal fragments per liter of soil. Detailed analysis of a randomly selected sample of 1,114 fragments identified white oak species (*Quercus spp. LEUCOBALANUS group*; 16 percent), oak (*Quercus sp.*; 4 percent), red oak (*Quercus spp. ERYTHROBALANUS group*; 4 percent), hickory *(Carya spp*; 1 percent), maple *(Acer spp.*;<1 percent), and flowering dogwood *(Cornus florida*; <1 percent) were identified. Sixty-three percent of the wood sub-sample was not identifiable.

The twenty-three nutshell fragments recovered from nine flotation samples included thick-walled hickory *(Carya spp*; 20 fragments) and acorn *(Quercus spp.*; 3 fragments). Twenty-seven carbonized and partially carbonized seeds were recovered from 23 percent of the 66 flotation samples. Weighing 0.11 grams, the seed assemblage comprised hawthorn *(Crataegus spp.;* 1 fragment), huckleberry *(Gaylussacia spp.;* 17 seeds), panic or foxtail grass *(Panicum/Setaria spp.;* 1 seed), sumac (*Rhus spp.;* 1 seed), raspberry or blackberry *(Rubus spp.;* 1 carbonized seed, 1 carbonized seed fragment), grape *(Vitis spp.;* 1 partially carbonized seed fragment), and, perhaps rose, *(ROSACEAE;* 1 seed fragment). Two seeds were not identified. In addition, 85 carbonized botanicals recovered from 41 percent of the samples represent buds, fungal fruit, fruit or flower stems, and, primarily, unclassifiable amorphous carbon.

The archeobotanical data from the 33 Phase III excavation units at the Warwick Site provide information about the history of human-plant interaction at the site and possibly in the northern Delmarva Peninsula more generally. The density of plant remains recovered from the Warwick Site is surprising, given the absence of cultural features. The Warwick assemblage yielded evidence of variety of potentially economically important plants. The carbonized remains of nuts and edible seeds, particularly the seeds of fleshy fruits, represent seasonally predictable mast and fruits. The assemblage also provides indicators of local landscape conditions. Wood charcoal identified from the sampled contexts documents burning of oak, especially varieties of white oak, and other native deciduous trees at one or more pointa in the past.

Recovery of all carbonized material from non-feature contexts renders any interpretation tentative, since charred materials may document historic land clearing, the impact of lightning strikes and other natural processes, as well as prehistoric activity. Nevertheless, the constellation of taxa typically exploited by prehistoric peoples and the high percentage of comestible genera within the nut and seed categories indicates that the material may have been deposited during the Late Archaic to Early Woodland occupation of the Warwick Site. If so, recovery of late-summer and fall ripening fruits (sumac, huckleberry, hawthorn, raspberry/blackberry, hickory, acorn), may reflect the season of occupation, though the recovered plant remains could reflect stored food resources consumed and discarded at any time of the year. Alternatively, the broad distribution of charred wood perhaps reflects prehistoric use of fire. Numerous ethnographic examples from throughout the world document landscapes intentionally burned to promote growth of useful plants, remove underbrush, or create microenvironments attractive to game, along with other practices (cf. Smith 2011). Charred nuts and seeds recovered from the

plowzone, therefore, may provide information about the past regardless of whether or not the charred botanical remains were consumed by the Late Archaic inhabitants of the Warwick Site.

The Warwick Site archaeobotanical assemblage represents the largest floral assemblage from a Late Archaic period site on Maryland's Coastal Plain. Comparable flotation-recovered archeobotanical assemblages from Late Archaic sites excavated in Maryland comprise a similar range of materials (Table 15). Comparable datasets from nearby Delaware include Late Archaic features at the Frederick Lodge Complex (7NC-J-97, 7NC-J-98 and 7NC-J-99) (Versar 2011a); Sandom Branch Complex (7NC-J-227 and 7NC-J-228) (Versar 2011b); Two Guys (7S-F-68) (LeeDecker et al. 1996); Hockessin Valley (7NC-A-17) (Custer and Hodny 1989); Puncheon Run (7K-C-51) (LeeDecker et al. 2005); Pollack (7K-C-203) (Custer et al. 1997); Delaware Park (7NC-E-41) (Thomas 1981); Hickory Bluff (7K-C-411) (Petraglia et al. 2002); Leipsic (7K-C-194A) (Custer et al. 1996); Carey Farm (7K-D-3) (Custer et al. 1996) and Lums Pond (7NC-F-18) (Petraglia et al. 1998). Wood charcoal was well represented at these sites, and a general pattern of Late Archaic subsistence focused on the wild products of a Coastal Plain forest (mast and fleshy fruits and small seeds) is evident. Of particular interest among the Delaware sites is the recovery of sumpweed *(Iva annua)* from Archaic contexts at the Two Guys Site. Appendix A provides greater detail about the flotation assemblage.

Table 15: Summary of Late Archaic Floral Data from the Coastal Plain of Maryland.

Name	Number	Number of samples	Liters	Description
Koubeck[1]	18CA239	1	7	Unidentifiable wood. Concentration of hickory nutshells (439 fragments [4.47 grams])
Chapmans Landing[2]	18CH380	1	1.5	Oak wood, galls, nightshade seeds
Beehive[3]	18HO206	13	>12	Woods: oak, hickory, ash, elm. knotweed and pigweed seeds
P-SWB-43 [4]	18PR723	1	4	Miscellaneous
Site 1 BARC Woods [5]	18PR545	2	4	Woods: oaks, hickory.

([1]Emory 2009; Emory and Cheshaek 2011; McKnight 2009; McKnight 2010; [2]Hornum et al. 1995; [3]Goodwin 1995; Maymon et al. 1996; [4]Parker 2006; Lothrop et al. 2006; [5] Hornum et al. 2000).

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