INTERPRETATIONS - OVERALL SITE

Some interpretations of the results of the excavations at the Pollack Site are best considered from an overall site perspective. These interpretations are noted below.

Blood Residue Analysis

A total of 967 blood residue tests were undertaken on artifacts from the Pollack Site. Unfortunately, only three artifacts had positive results which indicated the presence of blood residues. Background testing of soils did not yield any positive results; therefore, the positive test results for the artifacts probably do indicate that blood residues are indeed present. The very small percentage of positive results suggests that blood residues were not well preserved at the site. The large number of negative results do not indicate that blood was never present on the tools tested. Rather, the results simply indicate that blood residues are now no longer present on the tools.

Two of the artifacts with positive results were from Area B and both were from disturbed plow zone soils. One artifact was a point tip and another is a flake with no signs of edge retouch or utilization. A similar flake from the subsoil of Area C also yielded positive test results. The limited positive results show that unretouched flakes were used as cutting and scraping tools for processing game animals or fish. The positive reaction on the point tip shows that projectile points did indeed come into contact with the flesh of their targets and draw blood.

Analysis of Ceramic Technologies

A total of 480 ceramic sherds were recovered from all areas of the Pollack Site and 331 of these (69%) came from features in Area C. The vast majority of sherds were very small, less than two centimeters in diameter, and almost all of the features contained only a few sherds each. The Woods Area did produce a number of larger sherds (Plate 36), probably because the area had not been plowed and cultivation did not have a chance to damage sherds. Even in the Woods Area, however, few sherds could be mended to construct vessel segments. Nonetheless, the analyses of ceramic technologies provided below used vessel counts whenever possible because vessel counts have been shown to be more accurate than sherd counts (Rice 1987).

Surface Treatments. Table 56 shows the frequency of varied surface treatments among the different ceramic types found at the site. The majority of the sherds (76%) have wiped or smoothed surfaces and the remainder have cord-marked surfaces. No net-marked sherds are present. The presence of cord-marking has been linked to technological efficiency with respect to factors such as heat retention and vessel strength (Rice 1987), and at the adjacent Leipsic Site (Custer, Riley, and Mellin 1994), cord-marking also was the most frequent vessel surface treatment. The predominance of smoothed vessels in the Pollack Site sample may be due to its smaller sample size, or it is possible that the alleged technological effects of cord-marking have been exaggerated.

TABLE 56

Ceramic Surface Treatments

CERAMIC TYPE	CORD-MARKED SHERD COUNT	SMOOTHED SHERD COUNT
Wolfe Neck	1 (50%)	1 (50%)
Mockley	0 (0%)	1 (100%)
Hell Island	0 (0%)	5 (100%)
Townsend	0 (0%)	3 (100%)
Killens	10 (36%)	18 (64%)
Minguannan	11 (21%)	41 (79%)
Total	22 (24%)	69 (76%)

Net-marked sherds were absent from the Pollack Site, as they were at the Leipsic Site, and this absence is significant because all of the ceramic types listed in Table 56 have net-marked varieties (Custer 1989:171-176). However, the net-marked varieties have mainly been found at coastal sites in southern Delaware (e.g., Griffith and Artusy 1977). It was noted in the Leipsic Site report (Custer, Riley, and Mellin 1994) that it is possible that net-marked ceramics are more commonly found at coastal sites in southern Delaware because nets were more commonly used for fishing in southern Delaware and were, therefore, available for secondary use to impress ceramics.

It is almost certain, however, that fishing was an important subsistence activity in central Delaware drainages like the Leipsic River. Various studies (e.g., Daiber et al. 1976) have shown that anadromous species are present in the Leipsic River and these fish probably were also present in prehistoric times. If the absence of net-marked ceramics is truly linked to a lower incidence of nets at the Pollack and Leipsic sites, then alternative fishing methods might have been used. Ethnographic data from the local area (Feest 1978b) and elsewhere in North America (Bock 1978; Hilton 1990; Oswalt 1976) show a wide variety of fishtraps and weirs that could have been used for the mass capture of fish. These methods would have been just as effective as nets, and may have been used instead. On the other hand, coastal groups of southern Delaware may have sought different fish species or used different methods where nets were more effective. Future research with prehistoric ceramics should focus on the identification of regional trends in vessel surface treatments and their use as indirect evidence for perishable prehistoric technologies.

Surface Alterations and Vessel Functions. Ceramic vessel surface alterations are indications of vessel functions (Hally 1983; Rice 1987; Skibo 1992) and the presence of black soot deposits on exterior surfaces of ceramics is a good indication of the use of vessels for cooking. Table 57 shows the counts and percentages of sooted sherds for the varied ceramic types. In all cases, except Hell Island wares, sooting was present on 25 percent or less of the assemblage. The higher percentage for the Hell Island assemblage is probably due to small sample size. These data suggest that the majority of ceramics were not used for cooking and instead, many may have functioned as storage vessels. Gardner (1975) has suggested that food storage was an important function of prehistoric ceramic vessels in the Middle Atlantic region and the data in Table 57 support this contention.

TABLE 57
Ceramic Surface Alterations

CERAMIC TYPE	SOOTED SHERD COUNT	SOOTED PERCENTAGE
Wolfe Neck	0	0%
Mockley	0	0%
Hell Island	2	40%
Townsend	0	0%
Killens	5	18%
Minguannan	13	25%
Total	20	22%

It is important to note, however, that the interpretation of the data in Table 57 is complicated by the fact that sooting occurs more frequently on vessel bases and few clear-cut examples of vessel bases are included in the Pollack Site ceramic vessel assemblage. A similar phenomenon was observed at the Leipsic Site and the absence of vessel bases may cause the counts of sooted sherds to be under-represented.

The absence of vessel bases may be due to preservation factors (see discussion in Custer, Riley, and Mellin 1994), but it is also possible that the absence of bases is related to ceramic vessel use histories. Varied proportions of rim and basal sherds have been noted at several sites in the Middle Atlantic region (Custer and Mellin 1987, 1991; Stewart 1988) and this variation may be related to the ways vessels were used. It is possible that as vessels were used and rims were broken, basal sections of vessels were retained and "recycled" as smaller vessels of lower capacity, or as scoops and ladles. Rim sherds are more commonly seen at special function procurement and processing sites and basal sherds are more commonly seen at base camp sites. Both the Pollack and Leipsic sites are residential base camp sites, yet they lack basal sherds and do not match the patterns seen at other sites. Further research focused on ceramic vessel use histories is needed to better understand the varied uses of ceramic vessels.

Ceramic Artifact Frequencies. The small size of the Pollack ceramic assemblage has been mentioned numerous times and Table 58 shows a measure of ceramic sherds per feature for the Pollack, Leipsic, and Snapp sites. All of the densities are low, but the Pollack density is the lowest. This low density could reflect the erosion and disturbance of features by cultivation, but all three sites were probably subjected to these activities to an equal degree. It is also possible that ceramic density is related to settlement intensity and duration. In this case, the lower ceramic density at the Pollack Site could indicate that the individual occupations at the Pollack Site did not last as long as the occupations at the other sites. Further discussion of settlement intensity at the Pollack Site is presented later in this report.

TABLE 58

Ceramic Artifact Frequencies

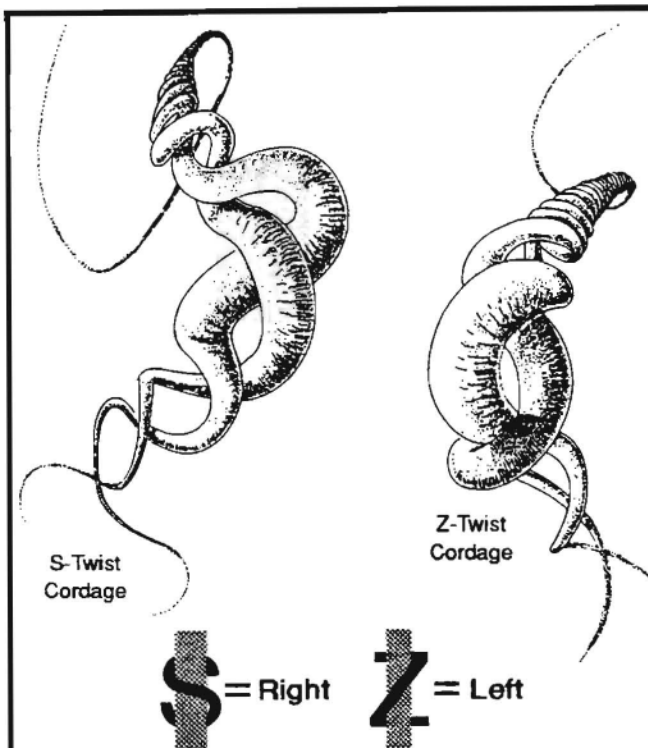
	SITES		
	Pollack	Leipsic*	Snapp**
# of Features	859	246	224
# of Ceramic Sherds	480	666	513
# of Sherds per Feature	<1	3	2

* Custer, Riley, and Mellin 1994
** Custer and Silber 1994

Textile Impressions and Cordage Twists. The cord-marking of ceramic vessels provides a record of perishable fiber technologies of cord production and attributes of prehistoric cordage have been recorded at other sites in Delaware (e.g., Custer and Silber 1994; Custer, Catts, Hodny, and Leithren 1990; Custer, Riley, and Mellin 1994). The twist direction of the cordage is of interest because some studies (Johnson and Speedy 1992) have suggested that cordage twist direction can be linked to ethnic group affiliations. Cordage twists can be either an S-twist or Z-twist direction (Figure 120).

FIGURE 120

Varieties of Cordage Twists

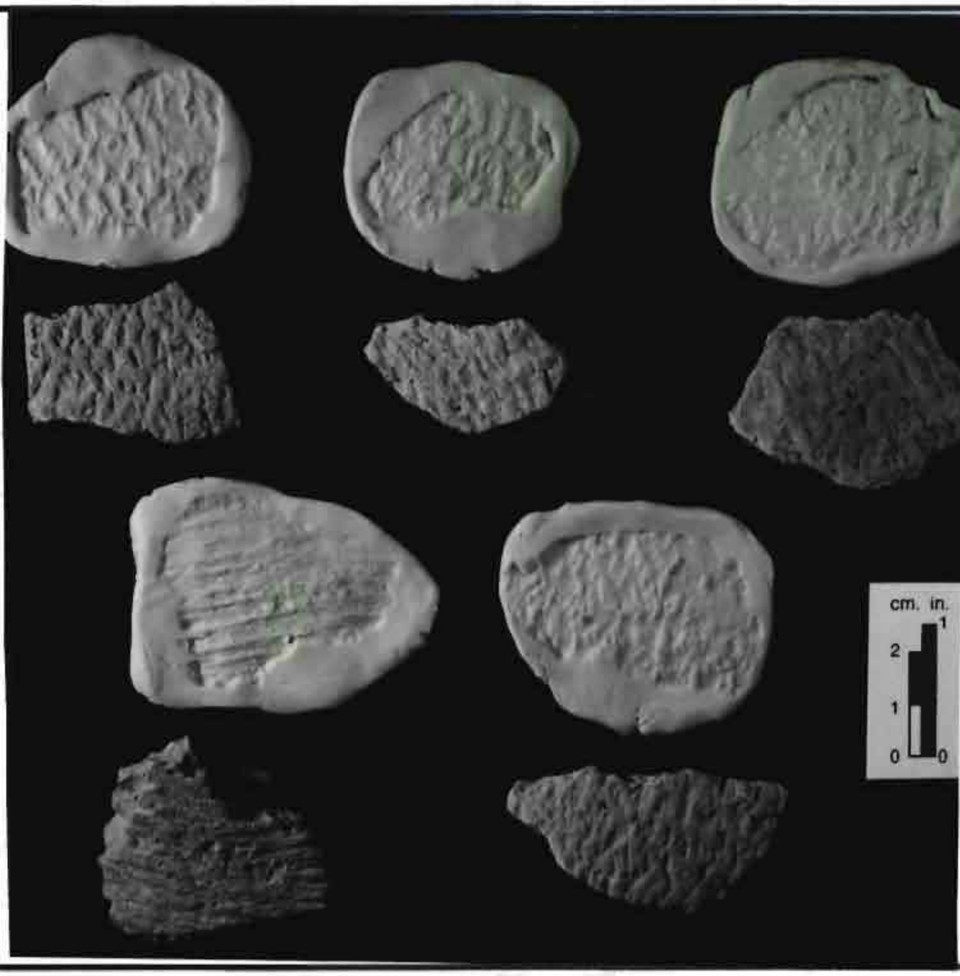


Direction of twist, spin or weft slant and symbols employed in their description (after Hurley, 1979)

Plate 37 shows some examples of ceramic sherds and their cordage twist impressions for Killens ceramics. Table 59 shows cordage twist data for the major ceramic types based on vessel counts. Z-twists are more common than S-twists

PLATE 37

Ceramics and Cordage Twist Impressions



Note: All ceramics are Killens Ware with S-Twist from woods excavation area.

by more than three-to-one; however, the sample is rather small. The context of the ceramic samples must also be considered in evaluating the data in Table 59. At the Pollack Site, the sherds used to record cordage data come from individual vessels from individual features. In no cases is there more than one vessel represented in each feature. If most of the individual features are related to individual houses, then there is one type of cordage twist for each house. In the case of Minguannan and Killens ceramics, where both types of twists are present in the overall assemblage, we can conclude that cordage twist direction varied on a household basis with some families preferring S-twists and some preferring Z-twists. Such household variation casts some doubts on the suitability of cordage twist data for discriminating different prehistoric ethnic and social groups in this region (e.g., see discussion in Custer, Riley, and Mellin 1994).

TABLE 59

Cordage Twist Data - Vessel Counts

CERAMIC TYPE	S-TWIST	Z-TWIST
Wolfe Neck	0	1
Killens	2	7
Minguannan	2	9

Killens Ceramics. The Pollack and Leipsic sites have now each produced dates which firmly place Killens ceramics (Plates 27 and 36) within the Woodland II time period. Now that these dates are available, a formal definition of Killens ware can be offered using the reporting methods described and applied by Griffith (1982). Appendix II contains the formal type definition.

Killens ceramics are significant because they provide a transition between the Woodland II ceramic technologies of northern and southern Delaware. Minguannan ceramics, more common in northern Delaware, are tempered with grit and finely crushed rock; whereas Townsend wares, more common in southern Delaware, are tempered with shell. In the past, some archaeologists have tried to link these varied ceramic technologies to different ethnic and social groups from the ethnohistoric record (shell-using Nanticoke versus grit-using Lenape). This distinction does not work well because the projected ethnographic range of the Lenape (Goddard 1978) extends well into the distribution of Townsend ceramics. Furthermore, the use of shell, grit, and combinations of these two materials as temper is more easily explained by simple availability of ceramic tempering agents. The presence of mixed shell and grit-tempered Killens ware in the middle section of Delaware fits well with explanations based on temper type availability.

Settlement Distribution

One of the special features of the excavations at the Pollack Site was the exposure of broad areas in numerous parts of the site (Figure 11). This large exposure allowed the development of research questions focused on the potential distribution of prehistoric settlement among the varied areas of the site. Figure 27 shows some hypothesized settlement distributions which are discussed in the research design section, based on various models of prehistoric settlement that have been used in Delaware. This section of the report will present settlement distribution data in relation to these hypotheses.

Table 60 lists a variety of artifact and feature densities for each excavation area that can be used to measure differential settlement intensity. Figure 121 shows the distribution of feature densities, measured in numbers of features per acre, for each area. Density measures were used in order to account for the varied sizes of the excavation areas. With the exception of Area F, the highest feature densities are seen along the Leipsic River and near its confluence with Alston Branch. The high density seen in Area F along Alston Branch is artificially inflated by its small sample size. In general, the focus of settlement on the Leipsic River is understandable because it is the larger drainage.

TABLE 60

Artifact and Feature Densities by Site Area

AREA	SIZE (ACRES)	# OF FEATURES	# OF FEATURES PER ACRE	# OF ARTIFACTS PER FEATURE*	# OF ARTIFACTS PER UNIT*
A	2.3	105	46	8	3
B	3.3	217	68	8	9
C	7.2	445	62	4	15
D	.7	34	49	2	1
E	.9	23	26	4	5
F	.3	20	67	7	--**
G	1.6	13	8	5	--**

* From Table 5.

** No data available. No units excavated due to low artifact densities in Phase II testing.

Figure 122 shows artifact densities per feature. This density measure provides an indication of settlement duration and intensity in that greater numbers of artifacts per feature would seem to be linked to more intensive settlements of longer duration. The data in Figure 122 would tend to show that settlements near the confluence of the Leipsic River and Alston Branch (Areas C - E) are less intensive and of shorter duration than those located further upstream on both drainages (Areas A, B, F, and G). This patterning is somewhat unexpected because conventional interpretations of prehistoric settlement patterns would view the confluence area as a preferable settlement location. Figure 123 shows the artifact densities per excavation unit and these data show higher artifact densities along the Leipsic River with the highest concentrations seen in the confluence area (Area C). The combined data in Figures 122 and 123 would, therefore, indicate that the confluence area was more frequently utilized; but, settlement in the confluence area was of shorter duration than that along the main stem of the Leipsic River. This utilization pattern may be due to the fact that the actual settlement areas of the banks of the Leipsic River away from the confluence area were better living locations. However, the natural environmental setting of the confluence area, with its extensive marshes, may have been a richer resource zone to exploit on a shorter term basis. In other words, if you came to live for a long time period at the Pollack Site, you camped along the main stem of the Leipsic River. But, if you came for a short-term visit to exploit the riverine and estuarine resources, you camped near the confluence of the Leipsic River and Alston Branch.

Figure 27 shows some hypothesized settlement distributions through time at the Pollack Site. These hypothesized distributions are somewhat difficult to assess because of the paucity of diagnostic artifacts. Nevertheless, some patterns can be noted. When prehistoric ceramics and diagnostic projectile points are considered, it is clear that the vast majority of settlement at the Pollack Site dates to the Woodland II Period in all areas of the site. From this large-scale perspective, it could be stated that the Pollack Site was primarily inhabited during Woodland II times and none of the hypothetical distributions in Figure 27 apply. However, some more refined analyses are possible. Nonetheless, it is important to remember that the main use of the Pollack Site occurred during Woodland II times and other settlement trends are minor factors within this broader pattern.

Table 61 shows a variety of measures of projectile point distributions among the site areas including the basic counts of pre-Woodland I, Woodland I, and Woodland II points, the number of points per acre, the percentages of each point type for each area, and the percentages of each point type among all areas. The figures for Area F are somewhat misleading due to its small size and it will not be considered. Figures 124 - 126 show the distribution of points/acre for each of the time intervals noted above. For pre-Woodland I points (Figure 124), there is little variation among the areas suggesting that pre-Woodland I settlement was not concentrated in any of the areas. For Woodland I points (Figure 125) the figures show settlement focused along the Leipsic River and in the confluence area (Areas B and C). Woodland II points (Figure 126) show concentrations similar to those for Woodland I points.

The percentages of point types for each area are shown in Figures 127 - 129. For example, in Figure 127 the 10 percent statistic in Area B means that 10 percent of the points in Area B dated to the pre-Woodland I time interval. The data for pre-Woodland I points in Figure 127 show that the highest percentages of pre-Woodland I points are seen in Areas D and G, not in Area C with its bay/basin features. For Woodland I points (Figure 128), high percentages are seen in all areas and there is little variation in the data. Areas A and E show the highest Woodland II point percentages (Figure 129).

TABLE 61

Projectile Point Distributions by Area

	A	B	C	D	E	F	G
POINT COUNT							
Pre-Woodland I	0	3	9	1	0	1	1
Woodland I	3	18	40	2	0	3	3
Woodland II	2	10	16	0	1	1	0
POINTS PER ACRE							
Pre-Woodland I	0	1	1	1	0	3	1
Woodland I	1	5	6	3	0	10	2
Woodland II	1	3	2	0	1	3	0
POINT PERCENTAGES WITHIN AREAS							
Pre-Woodland I	0	10	14	33	0	20	25
Woodland I	60	58	61	67	0	60	75
Woodland II	40	32	25	0	100	20	0
POINT PERCENTAGES AMONG AREAS							
Pre-Woodland I	0	20	60	7	0	7	7
Woodland I	4	26	58	3	0	4	4
Woodland II	7	33	53	0	3	3	0
Area Percentage	14	20	44	4	5	2	10

The last set of data in Table 61, which is depicted in Figures 130 - 132, shows the relationship between an areas's size and the percentage of points from each time period that it contained. For example, Area B contained 20 percent of the pre-Woodland I points and accounts for 20 percent of the excavated area of the Pollack Site. In this case, the pre-Woodland I points are proportionally represented in the area's assemblage. In contrast, Area A accounts for 14 percent of the total site area, but contains no pre-Woodland I points. In this case, the pre-Late Woodland I points are under-represented in the assemblage. Figure 130 shows the percentage comparison data for pre-Woodland I points. In Areas A and E these points are under-represented and in Areas C, D, and G they are over-represented. Woodland I points are also over-represented in Area C, but are under-represented in Area G (Figure 131). Woodland II points are not under-represented in any areas, but are over-represented in Areas B, C, and G.

In sum, the distribution data in Figures 121 - 132 seem to show that none of the hypothesized patterns noted in Figure 27 are present. Area C, at the confluence of the Leipsic River and Alston Branch, attracted prehistoric settlement for more different time periods than any other area. However, the other areas of the site show no concentrations of settlement during individual time periods, and Woodland II settlement is the most widespread and intensive settlement of the site as a whole. In the discussion of the research design it was noted that the alternative to the hypothesized distributions shown in Figure 27 was one where the general location of the Pollack Site was most attractive during Woodland II times within the context of the entire Leipsic drainage. And, in this scenario, the Pollack Site area was thought to be small enough so that intra-site resource distributions, such as those associated with the bay/basins or with changing salinity regimes in the stretch of the Leipsic River encompassed by the site, were irrelevant to long-term trends in site use. Based on the data noted above this alternative view is favored here. The confluence of the Leipsic River and Alston Branch was always attractive for settlement and was especially so during Woodland II times.

Analysis of Lithic Technologies

This section of the report will consider aspects of lithic technologies for the site as a whole and will utilize some of the data presented in the individual site area analyses. Comparisons of the site areas will also be included.

<u>**Area Assemblage Comparisons**</u>. Lithic utilization patterns can be compared among the different site areas and Areas A, B, C, D, E, and the Woods Area have large enough samples for comparison. Table 62 shows the four most commonly used materials, in order of decreasing frequency, for the total lithic assemblages of each area. Except for the Woods Area, cryptocrystalline materials, especially jasper, are the most commonly used materials in all areas. The Woods Area also differs from the other areas in that quartzite is the second most frequently used material. The Woods Area excavations, especially the larger block excavation (Figure 112), included numerous Archaic Period artifacts, while the remainder of the areas contained mainly Woodland Period occupations. This temporal difference explains the different lithic utilization patterns.

TABLE 62

Raw Material Use - Total Assemblage

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Jasper	Chert	Quartz	Quartzite
B	Chert	Jasper	Quartz	Quartzite
C	Jasper	Chert	Quartz	Quartzite
D	Jasper	Chert	Quartz	Quartzite
E	Jasper	Quartz	Chert	Quartzite
Woods	Quartz	Quartzite	Jasper	Chert
	HIGH ←			→ LOW

Raw material utilization for different artifact types was also compared among the areas. Table 63 shows the most commonly used materials for bifacial tools including early stage bifaces, late stage bifaces, and projectile points. For early stage bifaces, quartz is the most commonly used material in three areas, while jasper and chert are each the main materials in one area. Quartz is the most common raw material in the local cobble beds and its prominent use for early stage bifaces, which were almost certainly manufactured at the site, probably reflects local resource availability. Among late stage bifaces, cryptocrystalline materials, especially chert, are the most commonly used, and quartz is poorly represented in the assemblage, except for the Woods Area. These later stage bifaces may show different utilization patterns because they were brought to the site as part of a curated tool kit, rather than being manufactured from initial cobble reduction at the site. For projectile points, jasper was the most commonly used raw material in all areas and this pattern reflects either a special raw material selection for this tool type, or the reduction of elements of a curated tool kit. The presence of argillite in the point assemblages almost certainly reflects the reduction of curated tools because argillite is not available locally.

Table 64 shows raw material utilization for unifacial tools and the cores from which they were probably derived. The range of variability is greater for these artifact classes than any other class. Quartz and quartzite are more prevalent among these tool classes, especially cores, and again this utilization

TABLE 63
Raw Material Use - Bifacial Tools

Early Stage Bifaces

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Chert	Quartz	--	--
B	Quartz	Chert	Jasper	--
C	Quartz	Jasper	Argillite	Chert
D	Jasper	--	--	--
E	--	--	--	--
Woods	Quartz	Chert	Jasper	Argillite

HIGH ⟷ LOW

Late Stage Bifaces

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Chert	--	--	--
B	Chert	Jasper	Quartz	--
C	Jasper	Chert	Argillite	Quartz
D	--	--	--	--
E	Chert	--	--	--
Woods	Quartz	Chert	Jasper	--

HIGH ⟷ LOW

Points

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Jasper	Chert	Argillite	--
B	Jasper	Chert	Quartz	Argillite
C	Jasper	Chert	Argillite	Quartz
D	Jasper	--	--	--
E	Jasper	--	--	--
Woods	Jasper	Quartz	Chert	Argillite

HIGH ⟷ LOW

TABLE 64
Raw Material Use - Unifacial Tools and Cores

Utilized Flakes

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Jasper	Chert	--	--
B	Chert	Jasper	Quartz	Quartzite
C	Jasper	Chert	Quartz	Quartzite
D	Quartzite	Jasper	Chert	Quartz
E	Jasper	--	--	--
Woods	Jasper	Quartz	Chert	Quartzite

HIGH ⟷ LOW

Flake Tools

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Jasper	Chert	Quartz	Quartzite
B	Jasper	Chert	Quartz	Quartzite
C	Chert	Jasper	Quartz	Quartzite
D	Quartzite	--	--	--
E	Quartz	--	--	--
Woods	Quartz	Jasper	Chert	Quartzite

HIGH ⟷ LOW

Cores

AREA	FOUR MOST COMMON RAW MATERIALS			
A	Jasper	Chert	Quartz	--
B	Chert	Quartz	Jasper	Quartzite
C	Quartz	Jasper	Chert	Quartzite
D	--	--	--	--
E	Quartz	--	--	--
Woods	Quartz	Jasper	Chert	Quartzite

HIGH ⟷ LOW

pattern probably reflects local resource availability and casual resource selection for expedient tool production. It also shows that the prehistoric inhabitants of the Pollack Site were less selective with regard to raw material use for flake tools than they were for bifacial tools. The different raw material utilization patterns for unifaces and bifaces also suggest that by Woodland times, these two parts of the lithic tool kit were organized rather differently. In contrast, earlier tool kits show similarities between uniface and biface technologies (see discussion in Lowery and Custer 1990).

TABLE 65

Biface Stage Comparisons

Area	Early Stage Count	Early Stage Percentage	Late Stage Count	Late Stage Percentage	Early Stage Cortex Percentage	Late Stage Cortex Percentage
A	3 (3)	75%	1 (0)	25%	100%	0%
B	11 (3)	42%	15 (3)	58%	27%	20%
C	14 (5)	39%	22 (3)	61%	36%	14%
D	1 (0)	100%	0	0%	0%	--
E	0	0%	1 (0)	100%	--	0%
Woods	5 (1)	36%	9 (1)	64%	20%	11%
Totals	34 (12)		48 (7)			

(#) - Number of artifacts with cortex

Characteristics of the biface assemblages can be compared among the areas and Table 65 provides the relevant data. For the samples with more than five bifaces, late stage bifaces outnumber early stage bifaces. However, the differences are not that great. Early stage bifaces show higher incidence of cortex, as would be expected given the technological processes noted earlier in this report. In general, a variety of biface reduction activities took place in all areas of the Pollack Site.

Table 66 shows the cortex percentages in the composite artifact assemblages in Areas A - E and the Woods Area. The figures for all raw materials and the most commonly used raw materials, jasper and chert, do not vary all that much. Differences among the cortex percentages in Areas D and E are probably due to their smaller sample size. In general, the data in Table 66 show that secondary cobble sources were used to the same extent in all site areas.

TABLE 66

Total Artifact Cortex Percentages

	CORE PERCENTAGE				
AREA	Total	Quartzite	Quartz	Chert	Jasper
A	40	53	49	32	43
B	36	14	23	34	53
C	33	19	12	31	48
D	32	62	14	43	31
E	18	33	13	19	22
Woods	26	11	31	37	33

__Area Tool Kit Comparisons__. Areas A, B, C, and the Woods Area all have tool inventories large enough for systematic comparisons among themselves using the methods described by Lowery and Custer and applied in other Delaware Department of Transportation Archaeology Series reports (e.g., Custer and Silber 1994). Table 67 shows the cumulative percent data used in the comparisons and the data are derived from Tables 21, 25, 35, and 55. Figure 133 shows a compilation of the cumulative percent data for each area. The cumulative percent curves in Figure 133 show that the tool assemblages from Areas B, C, and the Woods are the most similar, although the Woods Area assemblage contains a larger of proportion of cores. Area A is different from the other areas in that it has a smaller proportion of formal flake tool types and more informal utilized flakes. Varied timing of the occupations within these areas may account for these differences in tool kits with Area A having more Woodland II occupations than the other areas, and the Woods Area having a more substantial Archaic component than the other areas. However, the paucity of chronological data for the site as a whole makes this explanation of tool kit diversity somewhat speculative.

Projectile Point Functions. Table 68 shows correlations of projectile point width and raw materials with patterns of point breakage that are related to point function. Although these artifacts are referred to primarily as "projectile points," implying that their main use was as a penetrating tip of a weapon, they were also used for other functions. Tip damage, which is indicative of point use as true projectiles (Odell and Cowan 1986), is present on 68 percent of the points (Plate 38) less than 20 millimeters in width and on 40 percent of the points more than 20 millimeters wide. Application of the difference-of-proportion test (Parsons 1974) shows that this difference is statistically significant at the five-percent level. Therefore, narrow points less than 20 millimeters wide more commonly functioned as projectile points than the points more than 20 millimeters wide. Similar conclusions have been derived from other studies (Custer 1991; Custer and Silber 1994; Custer, Riley, and Mellin 1994).

TABLE 67
Cumulative Tool Percentages Among Site Areas

	AREA			
	A	B	C	Woods
Points/knives	17	19	21	22
Late stage bifaces	19	29	31	32
Early stage bifaces	24	36	37	37
Drills	24	36	37	37
Concave/biconcave scrapers	26	38	37	37
Bifacial side scrapers	26	39	38	38
Unifacial side scrapers	29	40	41	43
Trianguloid end scrapers	32	42	44	46
Slug-shaped unifaces	32	42	44	46
Wedges	32	43	46	47
Primary cores	35	50	52	62
Secondary cores	46	52	54	65
Denticulates	46	52	55	65
Gravers	47	52	55	65
Regular utilized flakes	100	97	93	97
Blade-like utilized flakes	100	100	100	100

TABLE 68
Projectile Point Breakage Patterns

	Tip Damage Present	Tip Damage Absent	Medial Fracture Present
Point Width			
0 - 20 m	73	25	10
> 20 m	6	2	7
Raw Material			
Quartzite	3	0	0
Quartz	6	2	0
Chert	17	7	2
Jasper	42	17	14
Argillite	8	2	1
Ironstone	1	0	0
Rhyolite	0	1	0

FIGURE 133

Tool Kit Comparison Among Site Areas

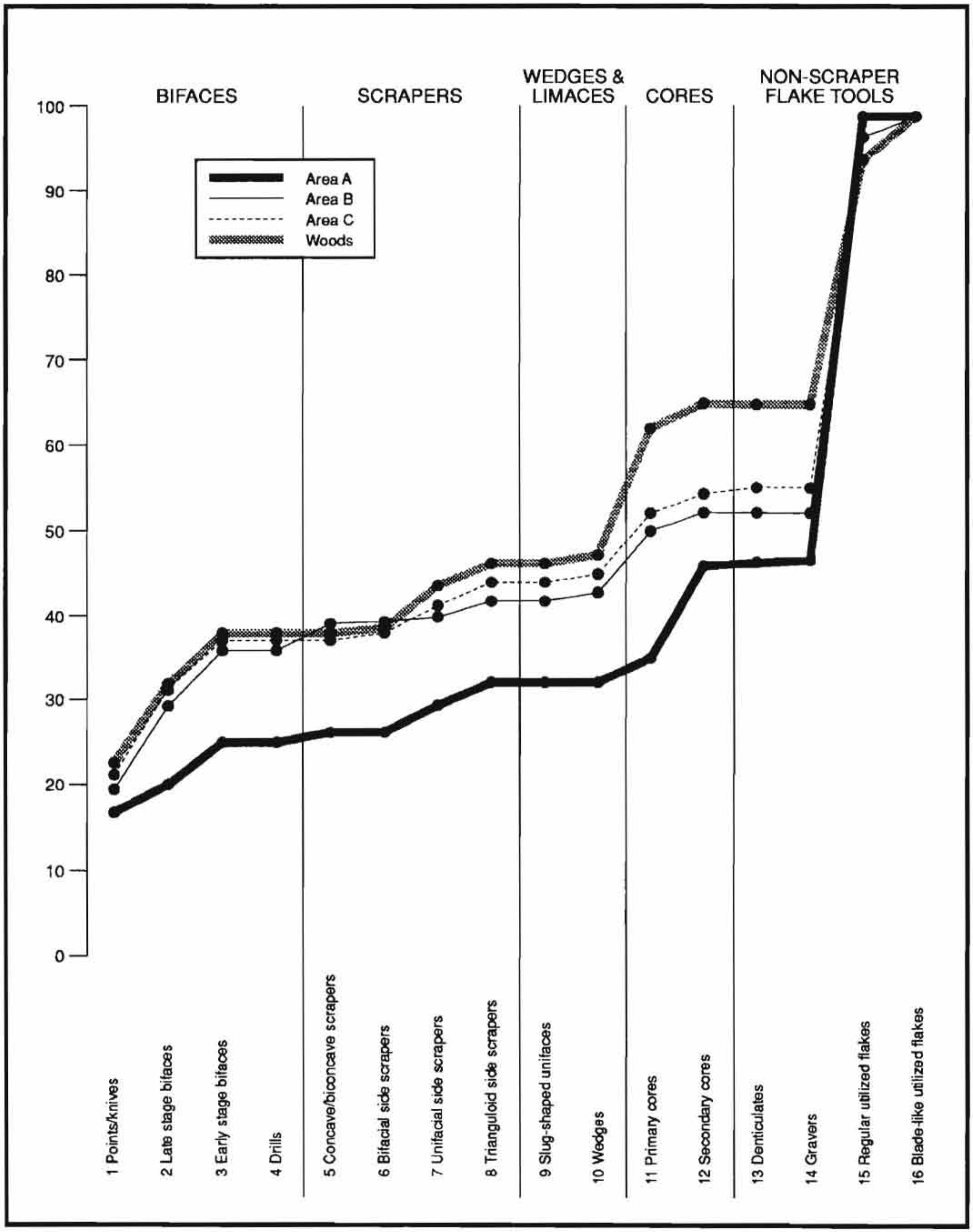
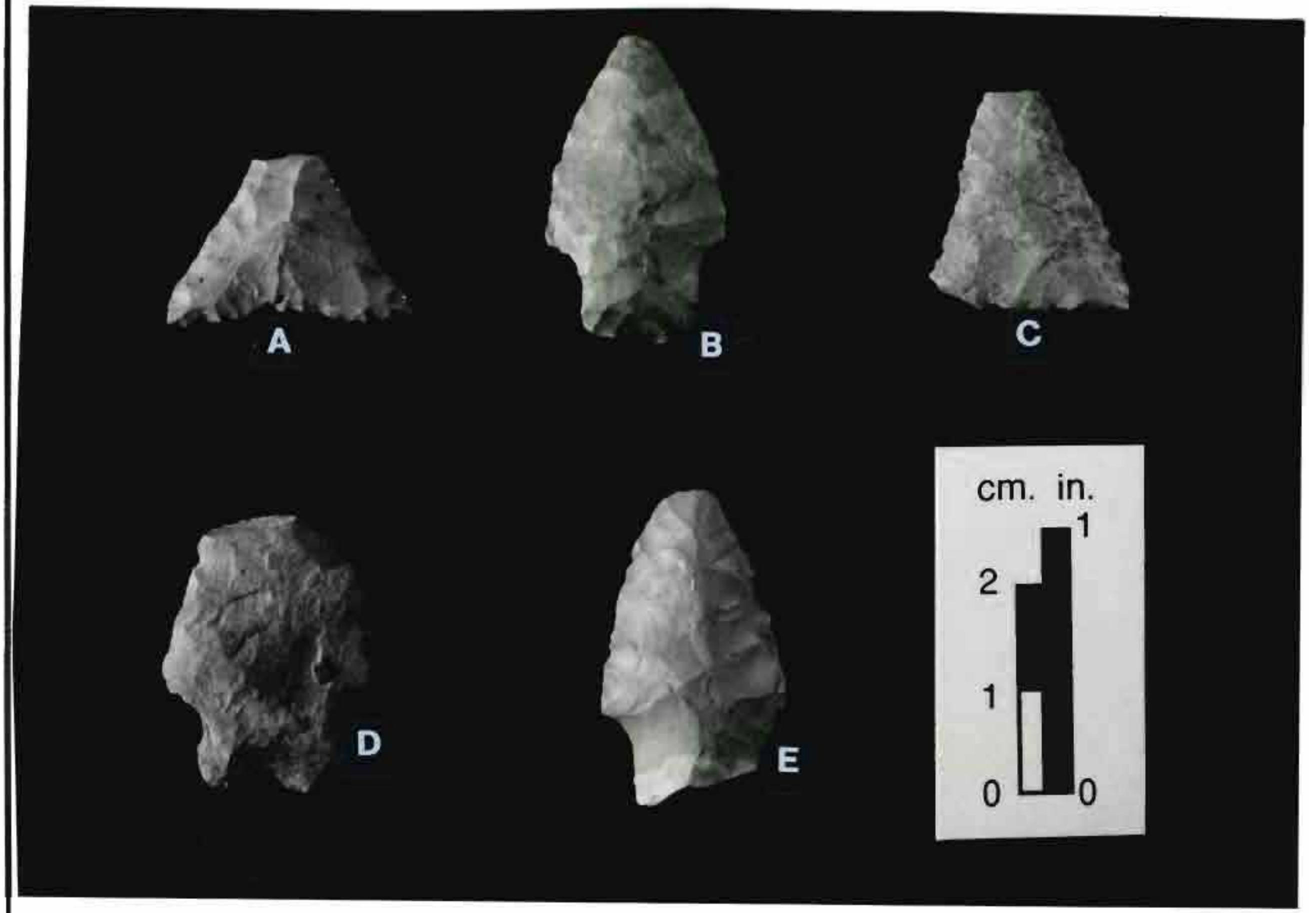


PLATE 38

Examples of Projectile Point Tip Damage



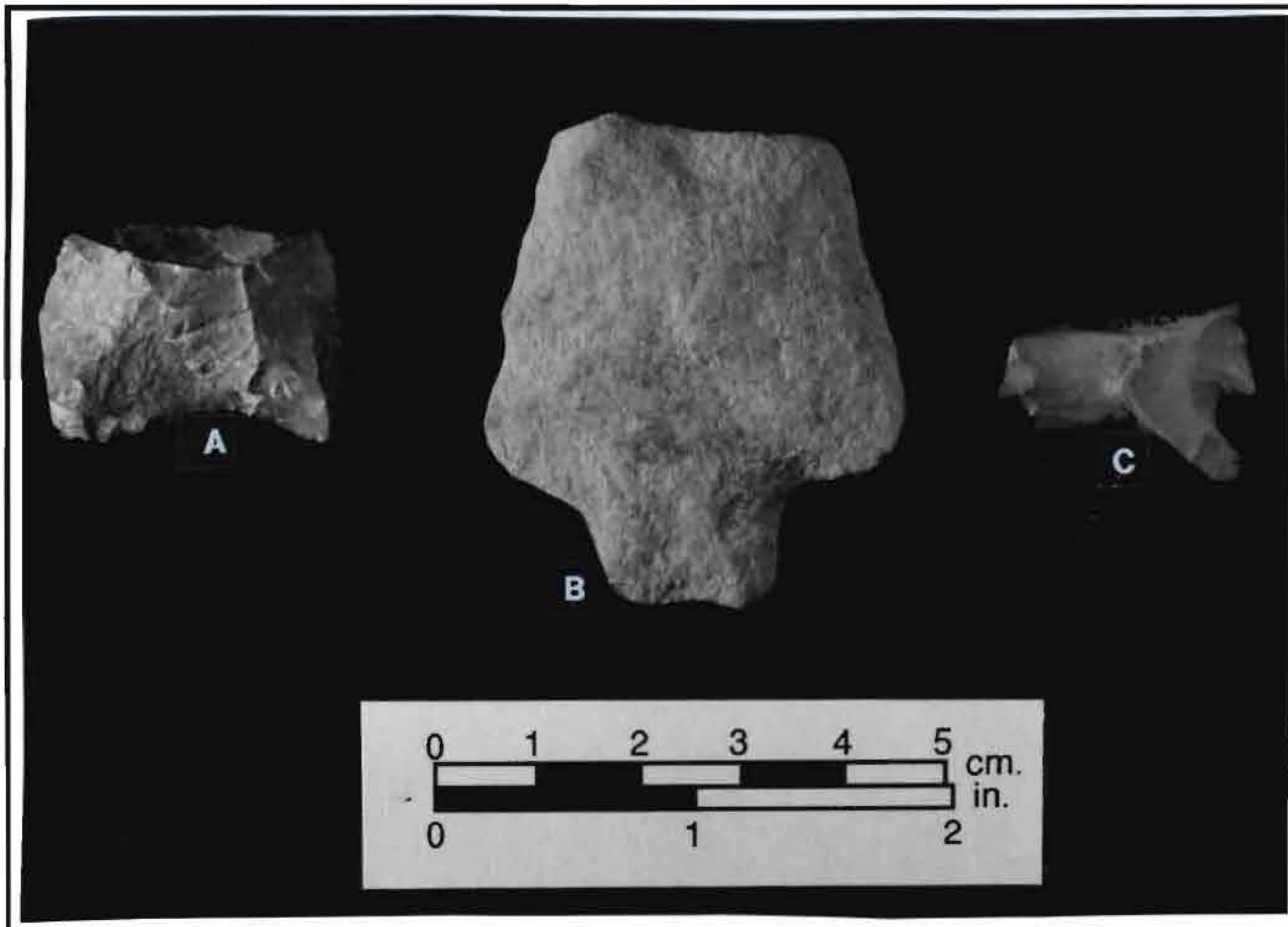
A - Jasper Triangle (91-37C-700) B - Jasper Type D (91-37C-100) C - Jasper Triangle (91-37-321) D - Jasper Bifurcate (91-37B-438) E - Jasper Type D (91-37-216)

Transverse medial fractures indicative of knife use (Truncer 1990) are also present in the assemblage (Plate 39) and their incidence is noted in Table 68. In some cases, transverse medial fractures occur on broken points with tip damage. The co-occurrence of these two breakage types, each associated with a different tool function, on individual points indicates that they were used for multiple functions including projectile point and cutting tools, such as hafted knives. Transverse medial fractures occur on nine percent of the narrow points and on 47 percent of the wider points. This difference is also statistically significant according to the difference-of-proportion test, and the results show that wider points were more likely to be used as hafted cutting tools than narrow points. Similar relationships between point width and knife use have been noted in other studies.

A cross-tabulation of raw materials and point breakage patterns is also included in Table 68. Chert, jasper, and argillite show significantly higher proportions of tip damage and these materials must have been more commonly used to manufacture projectile points. However, jasper points also show medial fractures indicative of knife use.

PLATE 39

Examples of Transverse Medial Fractures



A - Jasper Triangle (91-37F-12) B - Argillite Lehigh/Koens-Crispin Broadspear (91-37-165) C - Jasper Kirk/Palmer Variant (91-37S-152)

Flake Attribute Analysis. Debitage from selected features within the various areas of the Pollack Site were analyzed to identify the kinds of lithic reduction activities that produced them. This analysis specifically sought to identify if the debitage was the result of core reduction to produce flakes, which then would have been made into predominantly unifacial tools; or, if it was the result of biface reduction where the flakes were the by-products of the production of a biface. Stated another way, we sought to understand if the flakes were a desired end-product through core reduction, or if the flakes were simply waste materials resulting from the production of bifacial tools. This question is of interest because other data from the Delmarva Peninsula show that biface reduction was a dominant component of lithic technologies up to the beginning of the Woodland I Period; however, during the Woodland I and II periods, core reduction was more important and formalized biface reduction was not very common (Lowery and Custer 1990).

The flake analysis method used here is based on research presented in other reports in this series (Riley, Custer, Hoseth, and Coleman 1994) and recognizes a variety of attributes that can be used to identify debitage from core or biface reduction. An important point to note is that we have not used

TABLE 69

Flake Attribute Data

Attributes	Biface Control	Core Control	Area A Fea. 1	Area A Fea. 2	Area B Fea. 180	Woods Fea. 1	Area B Fea. 218
Flake Type							
Complete	12	63	76	62	78	82	84
Proximal	28	19	12	6	0	6	6
Medial	26	4	2	3	0	4	2
Distal	35	14	10	10	22	8	8
Flake Size							
Small	78	49	92	100	80	46	70
Medium	20	46	8	0	18	38	30
Large	2	5	0	0	2	16	0
Platform Shape							
Triangular	81	10	4	4	6	16	12
Flat	7	37	20	8	12	10	22
Round	12	35	64	62	60	62	55
Remnant Biface Edge							
Present	19	3	8	2	6	0	4
Absent	81	97	92	98	94	100	96
Platform Preparation							
Present	88	10	36	8	14	18	36
Absent	12	72	52	66	64	70	54
Scar Count							
Mean	2	1	3	2	4	2	3
Standard deviation	1	1	2	1	2	1	2
Scar Direction							
Mean	2	1	2	2	3	1	2
Standard deviation	1	1	2	1	1	1	1

these attributes to take individual flakes and identify them as core or biface flakes, as has been done by some researchers. Rather, this research seeks to identify the overall distribution of certain attributes within an assemblage of flakes and then identify the type of reduction activity that most likely produced the assemblage. This assemblage approach has been shown to be more accurate than the individual flake approach (Lowery and Custer 1990).

Because assemblages of flakes are needed for this type of analysis, it is important to consider the context of the flake samples utilized. Samples of 50 flakes are required and these flakes must be from well-defined contexts so that it can be reasonably assumed that the flakes date from a limited point in time. Consequently, plow zone samples, samples from mixed contexts, and samples from excavation units with low artifact frequencies cannot be used. For the Pollack Site, there were five dated samples from reasonably good feature contexts that were large enough to be used for analysis. These features included Features 1 and 2 from Area A, Features 180 and 218 from Area B, and Feature 1 from the Woods Area. All of these features date to the Woodland II Period and form an interesting basis for comparison among themselves.

PLATE 40

Flakes from Experimental Production of Stone Tools

Table 69 shows the basic flake attribute data from the features as well as from two control samples. The control samples consist of flake samples (Plate 40) that were derived from known core and biface reduction activities (Plate 41). The basic method of analysis is to compare the percentage attribute distributions of the Pollack Site samples with the control samples and decide if the Pollack samples are more similar to core or biface assemblages. The selection of the attributes used is based on the work of Verrey (1986), Magne (1981), and Gunn and Mahula (1977) and syntheses of these studies with respect to Delmarva Peninsula data (Lowery and Custer 1990; Riley, Custer, Hoseth, and Coleman 1994).

A summary of the flake attribute analyses is presented in Table 70. The overwhelming majority of the data show that the debitage most likely resulted from core reduction. Five of the variables (flake type, flake size, platform shape, presence of remnant biface edges, and presence of platform preparation) are especially good discriminators of flake sources (see discussion in Riley, Custer, Hoseth, and Coleman 1994), and for these attributes the Pollack Site flake assemblages are strongly associated with core reduction. The attributes of scar count and scar directions show more affinity with biface assemblages; however, these variables have been shown to be less effective when used to discriminate between core

PLATE 41

Bifaces Replicated by Errett Callahan for Experimental Study of Debitage

TABLE 70

Flake Attribute Summary

Attributes	Area A Fea. 1	Area A Fea. 2	Area B Fea. 180	Woods Fea. 1	Area B Fea. 218
Flake Type*	C	C	C	C	C
Flake Size*	C	B	C	B	C
Platform Shape*	C	C	C	C	C
Remnant Biface Edge*	C	C	C	C	C
Platform Preparation*	C/B	C	C	C	C/B
Scar Count	B	B	B	C	B
Scar Direction	B	B	B	C	B

* - Most critical discriminating variables C - Similar to core attributes
B - Similar to biface attributes C/B - Intermediate between core and biface

and biface assemblages. Furthermore, the values for these two attributes in Table 69 show that the standard deviations are large with respect to the means, indicating that there is a great deal of variation in the data for these attributes. This large amount of variation makes the biface identifications suspect.

To summarize the results of the flake attribute analysis, the data show that the debitage from the Woodland II features is primarily derived from core reduction. Biface reduction does not seem to be a major activity in and around the house features that produced the samples that were analyzed. These findings match with the results of other studies which suggest that by Woodland II times, biface reduction was uncommon and that a large percentage of Woodland II triangular projectile points were made from flakes (see discussion in Custer 1989). Cortex percentages were also rather high for these samples, ranging from 38 to 56 percent, and this observation shows that secondary cobbles and pebbles were the most likely source of the cores that were reduced.

DISCUSSION AND CONCLUSIONS

This final section of the report will discuss some of the implications of the interpretations of archaeological data recovered from the Pollack Site. A short summary of the data from the site is presented along with discussions of paleoenvironments, cordage twist data, regional lithic technologies, subsistence systems, and household, community, and regional settlement patterns. Where applicable, potential future research directions are noted.

Site Summary

The land at the confluence of the Leipsic River and Alston Branch was an attractive locale for human settlement for more than 10,000 years. A variety of projectile points spanning the period between 8,000 B.C. and A.D. 1500 were recovered from the site and testify to the intermittent and repeated reoccupation of the site. Up until ca. 2500 B.C., the occupations were rather ephemeral and the only signs of their presence are projectile points and waste flakes from the manufacture of stone tools. These artifacts are mixed with the remains of later occupations and diagnostic projectile points are the only certain signs of these early occupations.

Some time after 3000 B.C., prehistoric groups began to spend more time at the various areas at the Pollack Site. These later inhabitants built circular to oval houses with bent saplings as supports for roofs of bark, hides, or rushes (Plate 19). The houses also had interior fireplaces, an excavated "basement"-like depression almost as large as the house itself, and a "sub-basement" storage pit. Outdoor storage pits and fireplaces were also present.

All of the houses are relatively small and would have housed individual families. At any given time in the past, there was probably only one household living at the site. Lithic and ceramic debris were found in some of the pits inside the houses indicating that the pits were used as refuse receptacles after they were no longer used as storage pits. The occupations probably lasted less than one year, and the presence of interior fireplaces in some of the houses suggests that the occupation spanned the cold-weather months. There seems to be little change in the way the site was used, and the households who used it, from approximately 2500 B.C. to A.D. 1500.