APPENDIX M

EXPERIMENTAL REPLICATION OF A "PEBBLE POINT"

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By

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I. INTRODUCTION

This replication study will try to show that an understanding of prehistoric stone technology can be aided by the replication and analysis of lithic forms found within archaeological settings. Modern replication of ancient tools is essentially a simulation of the processes and techniques that may have been responsible for the manufacture of formal tool types present within an artifact assemblage (Crabtree 1972; Kelterborn 1984). Replication studies are attempts to recreate the sequence and methods of reduction activities and to categorize the forms of lithic by-products generated by those activities (Patterson 1982, 1990). Comparisons between the structure of the replicated assemblage and the archaeologically recovered artifacts may be useful in reconstructing the range of technologies used by prehistoric flintknappers and in assessing the site formation processes that transform the archaeological record.

Modeling ancient flintknapping technologies on replication studies takes advantage of our ability to record the precise sequences and methods of tool reduction and to obtain size, weight, and trait characteristics on the entire assemblage of reduction by-products. The collection of base line data from the experimental samples allows us to make inferences about those reduction pathways that best approximate the composition of the tool and flake types found in the ground.

For this project, the Puncheon pebble point was selected for replication because it was the most common formal tool type in the archaeological collection.

II. STUDY METHODS

A. RAW MATERIAL

If replication is meant to reproduce the forms of archaeological artifacts as an end toward modeling reduction strategies, then it is necessary to consider the types of lithic raw materials used to approximate those forms. Raw materials are subject to variations in their flaking patterns depending on density, internal cleavage, and inclusions. These physical characteristics of rock often result in flakes of contrasting size and shape without regard to the mode of reduction. To limit this potential bias as much as possible, all of the cobbles used in the experimental sample were obtained locally from an exposed deposit along the Puncheon Run. Cobble selection was made on the basis of an assessment of suitability that factored in shape, size, probable raw material, other visual clues such as obvious fracture planes, and somewhat intangible elements such as "feel," which a flintknapper might translate as the roughness or granularity of the cobble. The goal was twofold: to collect raw materials that were similar to the archaeological sample, and to select cobbles that were likely to be knappable into replicant pebble points.

Samples were discarded upon initial reduction if raw material, granularity, or cleavage appeared unsuitable to achieve a finished point. Testing and rejecting flawed material at the early stage of lithic reduction is an efficient way to reduce investment in later production failures. This strategy was apparently widely utilized by Native American flintknappers exploiting cobble sources. At the Puncheon Run Site this technical approach is most clearly seen at the Cobble Bar area, a cobble quarry in Locus 1 where two-thirds of the cores were tested cobbles, that is, cobbles that were set aside after one or two flake removals and underwent no further reduction.

B. FLINTKNAPPING TECHNIQUES

The mode of reduction employed on all cobble samples was a type termed freehand reduction. In this method of tool manufacture a hammerstone is used to split open a hand-held cobble, with the aim to remove cortex (decortication) and to create a striking platform. Because percussion flaking is best controlled when the applied force is directed in a straight line through the core, the preparation of a flat platform is the first stage in the manufacture of a tool. This means that the spherical surface of a stream cobble must be eliminated through decortication to arrive at workable striking platforms.

Freehand reduction is generally contrasted with bipolar reduction, in which the cobble is placed on a rock anvil and split by a hammerstone. Different diagnostic flake forms are generated by each method. A common theme in much recent lithic research (e.g., Stevens 1998; Stewart 1987) is that bipolar reduction was the preferred mode of tool production for small cobbles and pebbles because of the difficulty in handling the smaller cores. A corollary to this idea is the perception that bipolar reduction is more efficient at extracting the maximum amount of usable stone from a core. Following this logic, in the Middle Atlantic coastal plain, where small cobbles are the sole local source of lithic raw material, a high level of bipolar reduction activities should be evident in the archaeological record. This is not the case at the Puncheon Run Site, where bipolar cores constitute slightly less than one tenth of the total core sample (32 of 339). The replication study is expected to be able to test whether the Puncheon pebble points could have been manufactured from small cobbles employing only freehand reduction.

> *Hypothesis 1*: Pebble points can be made from local cobbles using freehand reduction alone.

C. ANALYTICAL TECHNIQUES

Researchers have generally classified debitage using either a trait-based or a size-based approach. Trait-based analysis proceeds from an examination of flake attributes that are assumed to be the diagnostic products of specific modes of lithic reduction, or stages in a sequence that may begin with decortication and end with bifacial thinning and pressure flaking. Proportional frequencies of flake types have been used as the basis for interpreting tool production technologies and the identification of distinct industries. This approach has the advantage of identifying common traits among flakes independent of size. Similar forms are interpreted as resulting from uniform processes. Though still commonly employed for its interpretive and organizational strengths, the use of formal flake attributes has come under criticism because of the inherent subjectivity in recognizing individual specimens as specific attribute types (Ahler 1989; Shott 1994). In addition, it is uncertain whether flake attributes are diagnostic of only one sort of knapping behavior. It is far more likely that similar traits can be produced by the actions of multiple behaviors, thus calling into question the value of flake assemblages in making reliable inferences about human culture.

Trait-Based Debitage Classes

- Biface Reduction Flake
- Block Shatter
- Decortication Flake
- Early Reduction Flake
- Flake Fragment
- Flake Shatter
- Pressure Flake

An alternative approach to the analysis of lithic debris comes from viewing debitage in the aggregate, rather than individually. This has two chief advantages. First, this approach eliminates the subjective characterization of flake attributes, relying instead on objective, replicable traits, such as size and weight. Second, data sets resulting from such analysis are more easily comparable between assemblages regardless of what institution or researcher did the coding. The method that has gained the most attention is one based on the distribution of size-grades in flake assemblages, and which has been termed *mass analysis* by Stanley Ahler (1989:89). Utilizing selected size-grade intervals, Ahler was able to demonstrate relationships between flake size ratios and lithic reduction techniques in both experimental and archaeological assemblages. For the Puncheon Run Site, Berger utilized a system of nine size grades (see box below).

Debitage Size Categories
(millimeters)
< 6 mm
6-10 mm
1-15 mm
16-20 mm
21-30 mm
31-40 mm
41-50 mm
51-60 mm
> 60 mm

Both the trait-based and mass analysis methods were used in this study to analyze replicant debitage in an effort to compare the two approaches and evaluate their abilities to provide explanatory narratives for the artifact patterns.

> *Hypothesis 2*: Size-based flake analysis can be used to describe reduction modes and sequences.

D. TARGET SAMPLE

The most common type of projectile point at Puncheon Run is the narrow-blade small-stem variety, of which 42 specimens were found. Because a majority of the sample exhibits remnant cobble cortex on the stem base, and to a smaller extent on the blade, this point type was probably associated with a cobble reduction industry. Most, if not all, of these points are assumed to be derived from locally obtained cobbles and large pebbles and for this reason are named *Puncheon pebble points*.

Lithic raw material can be obtained directly from two basic sources, bedrock outcrops or secondary cobble deposits. In the Coastal Plain environment of the Puncheon Run Site, cobble deposits are common, but bedrock exposures would have been virtually unavailable to prehistoric populations. Scattered across the Puncheon Run landscape, cobble deposits in exposed and near-surface contexts are the product of Pleistocene-era fluvial actions that created most of the surficial geology of Kent County, Delaware. It has long been noted that such secondary deposits are the only locally available lithic sources in the Middle Atlantic coastal plain and may have been a critical factor in prehistoric settlement patterns within the region. Cobble cores have the disadvantage of having a spherical shape that must be eliminated, or at least reduced, to create flat striking platforms conducive to the production of flake tools or bifaces. A third source of lithic raw material is through trade, but ultimately every piece of stone starts as either a block or cobble.

A bifacial core can be described as the mirror image of a biface. A biface emerges from a core by the removal of excess stone in much the same way that a statue develops from a raw block of marble. The excess stone is the by-product of the biface manufacturing process. The purpose of a bifacial core, on the other hand, is to generate flakes that are themselves shaped into tools, with the core itself the remnant by-product of that process. Its form, though bifacial, is not an end in itself, but simply the consequence of the production of usable flakes.

The Puncheon pebble points are rather thick bifaces with contracting to straight stems. The shoulders are generally weakly formed and edges are minimally fashioned by pressure flaking. Several of the points in the sample display medial ridges that extend up one side of the blade. Judging from a few unfinished bifaces that exhibit the same sort of trait, it appears that decortication flaking exposed an entire face of the preform, rather than creating first one edge and then the other. The flaking pattern on a chert early-stage biface from Locus 3, Unit 85 (Cat. No. 97/55/142), created a medial ridge that terminated at the base, leaving a triangular-shaped patch of basal cortex (the tip of the triangle intersects the ridge) (Plate M-1). This cortical shape is seen on many of the finished pebble points and may indicate that exposure of an entire blade face was a common production technique. One purpose may have been to ensure the formation of sufficient striking platforms along both edges of small preforms.

The Puncheon pebble points were overwhelmingly made from cryptocrystalline raw material, principally jasper (N=25) and chert (N=12). Three points were manufactured of quartz and one each of siltstone and argillite. The sample of complete pebble points (N=33) has a mean length of 39.9 millimeters, mean width of 20.1 millimeters, and mean thickness of 8.3 millimeters (see Attachment A). The mean weight of the complete specimens is 5.9 grams. Of 25 points examined for microscopic use-wear, 21 yielded evidence suggesting that they functioned as piercing implements. Because none of these points exhibited hafting breakage, it is more likely that they were used as hand-held rather than projected weapons (Flenniken and Raymond 1986:607). If these points were used as fishing spears or "gaffers," it may explain the fact that they were clustered in Locus 3 at a location close to the St. Jones River. Use-wear analysis also indicates that three points appear to have been re-used as scrapers after tip breakage.

PLATE M-1: Three Views of Early-Stage Biface, Catalog No. 97/55/142, Showing Medial Ridge

The pebble point was targeted for replication study because it was the most common formal tool type and because the heavy concentration of these points in the dense artifact deposits of the Metate block affords the opportunity to reach a better understanding of the origins of this activity zone. One hypothesis that will be explicitly tested is that ancient flintknappers at Puncheon Run adjusted to the absence of bedrock sources by using whatever cobbles were locally available.

> *Hypothesis 3*: The selection of raw material for tool production was based on a strategy of collecting cobbles from the nearest available deposit, rather than ranking cobbles according to an optimum size and shape.

III. RESULTS OF STUDY

A total of 13 implements were replicated, including five projectile points, one early-stage biface, three middle-stage bifaces, and four late-stage bifaces (Plate M-2). Attachment B provides a summary of the replicants, including raw material, finished form, size parameters, and remarks about production failure. Characteristics of the associated debitage are given in Attachment C. In addition to these 13 implements, a few attempts at tool production ended after removal of a few flakes to examine the suitability of the raw material. The end product of these activities would be classified as *tested cobbles* in an archaeological assemblage.

The five replicated points include two chert and three jasper specimens. All exhibit the general morphological characteristics of the typical Puncheon pebble point (narrow blade, short stem, minimal edge retouch) and all exhibit basal cortex. The replicants differ from the archaeological points in their overall size, being larger than the excavated sample. A difference of means test (t) was used to determine whether the size differences between the replicants and the archaeological specimens are statistically significant. For all measurements (length, width, and thickness), as well as the ratio of width to length, the two groups

PLATE M-2: Replicant Tools. Top Row, Left to Right: Catalog Nos. 9914, 9903, 9908, 9905, 9915. Middle Row, Left to Right: Catalog Nos. 9906, 9913, 9911, 9909, 9916. Bottom Row, Left to Right: Catalog Nos. 9902, 9912, 9904

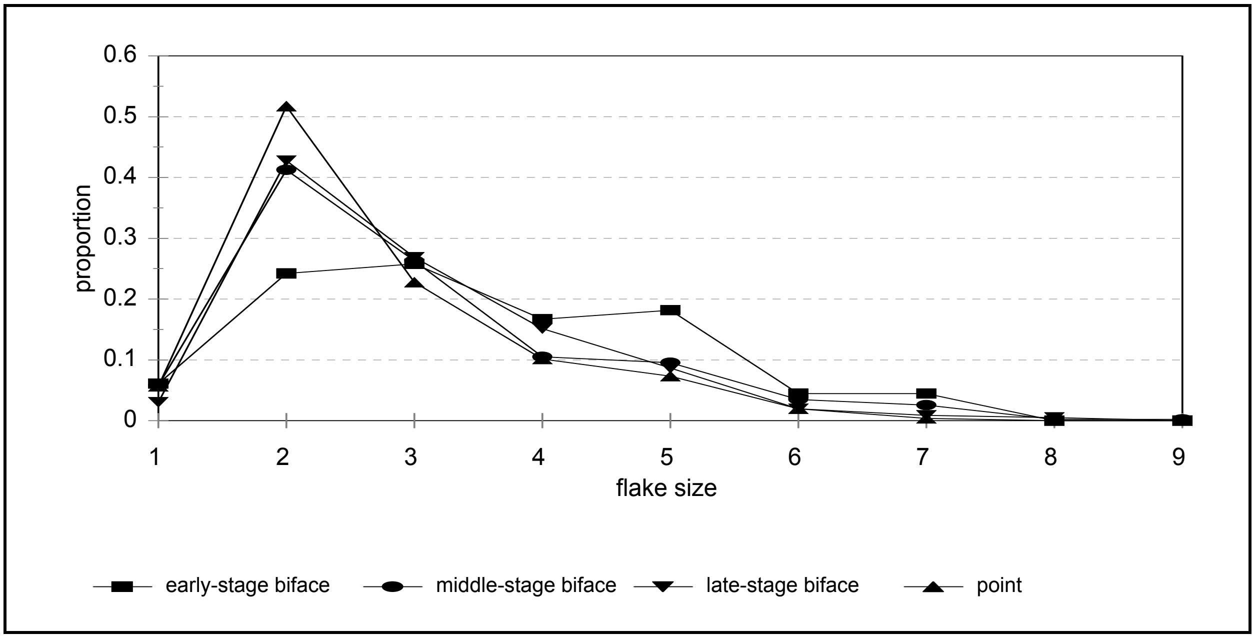

FIGURE M-1: Flake Size Distribution for Replicant Forms

represent distinctly different groups (p<.05). When differences in the ratio of width to thickness were examined, the two groups could not be distinguished statistically.

The replicants exhibit only a slightly more slender blade outline, as expressed in the width-to-length ratio 0.4:1, compared to 0.5:1 for their counterparts from archaeological contexts. The broader blade forms of the archaeological specimens may reflect resharpening or rejuvenation of the blade edges or technological/stylistic differences of the ancient and modern flintknappers. The replicants also display a thicker blade cross section, expressed in a width-to-thickness ratio of 2.2:1, compared to 2.4:1 for the archaeological sample. However, the width-to-thickness ratios of four out of five replicants lie within the inter-quartile range of the archaeological pebble points, in other words, within the central 50 percent of the archaeological ratio distribution, indicating that, proportionally, the replicants closely resemble the counterparts.

Table M-1: Relative Proportion of Selected Flake Sizes by Reduction Stage

	Reduction Stage			
Flake Size	**Early-Stage**	**Middle-Stage**	**Late-Stage**	**Point**
6-10 mm	24	41	43	52
21-50 mm	27	16	12	10

Note: Values expressed as percentages.

The similarity of the replicant and archaeological samples with regard to their overall design and to their proportional dimensions means that we can accept Hypothesis 1, that pebble points can be made from local cobbles using freehand reduction alone.

An examination of replicant debitage generated at each stage of the reduction process reveals significant differences in flake size distributions (Figure M-1).

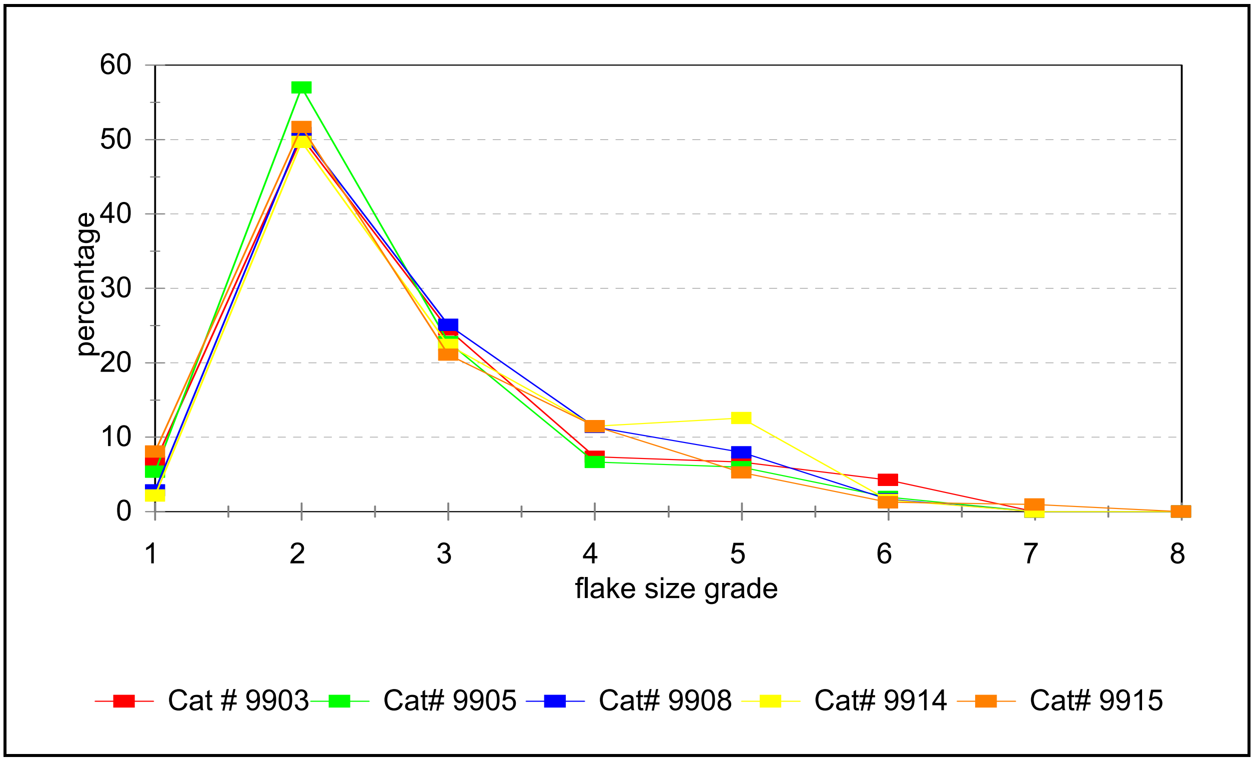

FIGURE M-2: Flake Size Distributions of Replicant Pebble Points

The distribution curves reflect the aggregate debitage for early-, middle-, and late-stage bifaces, and projectile points, and illustrate distinctive signatures for each reduction stage. In particular, there is a clear relationship between reduction stage and the frequency of small debitage between 6 and 10 millimeters; finished points generated the most debitage of this size, early-stage bifaces the least (Table M-1).

At the other end of the scale, for debitage measuring between 21 and 50 millimeters this relationship is inverted, as the proportion of large flakes decreases with the progression from early-stage biface to point. These findings are consistent with some general understandings of bifacial reduction that assert that debitage becomes smaller and more numerous as reduction progresses. As Shott (1994:90) notes, however, by itself this observation is not particularly enlightening. What makes it useful, however, is the capacity of mass analysis to describe distribution curves for archaeological data sets that can be compared with the debitage from known experimental samples.

The debitage generated by the five replicant points produced highly congruent size distribution curves (Figure M-2), judged to be the result of a high level of behavioral uniformity by the flintknapper independent of raw material or cobble size. Plate M-3 illustrates one of the completed points together with the debitage generated during its manufacture.

Using the replicant data as a base line, debitage from the Metate block was examined for similarity with the known reduction sequences. With the exception of flakes in the 11- to 15-millimeter range, the size distributions of jasper debitage (N=1,913) closely paralleled the curve of debitage generated by the replicant points (Figure M-3). In contrast, the quartz debitage (N=1,739) exhibited a stronger affinity to the debris characteristics from the replicant early-stage biface (see Figure M-3). This observation correlates with the composition of the tool assemblage from Metate block, where jasper accounted for 22 of 37 points (59 percent) and quartz was used for only two points but also half (9 of 18) of the early-stage bifaces. On the basis of these findings we can accept with some confidence Hypothesis 2, that mass analysis can be used to describe accurately specific reduction sequences in an archaeological assemblage.

Another way of looking at mass analysis is to substitute weight for length in the classification of debitage. The two measurements clearly co-vary, and weight has been demonstrated to be a reliable flake attribute in predicting lithic reduction stages (Shott 1994:80). As expected, mean flake weights of the replicants reflect the reductive nature of tool production, with later stages producing progressively smaller flakes. An unexpected result of plotting flake weights by cobble size is the linear strength of the relationship. Not only is mean flake weight a dependent variable of the reduction stage, but cobble weight appears also to co-vary with reduction, at least within the sample population of the replicant tools. Based on the data generated by the replication study, this suggests that pebble points may be most effectively made from cobbles weighing less than about 100 grams. Two possible explanations are explored below.

First, there is a clear advantage in the technical ability to reduce small cores into operational tools; fewer motions are needed to produce a point from a small cobble, resulting in a gain in energy efficiency. In addition, small cobbles are more easily transported to the work station than are large ones. Second, as cobble size increases, so too does the possibility that it will contain cleavage planes or mineral inclusions leading to a production failure. A direct relationship between the percentage of reduction-generated block shatter and cobble size bears out this point. Block shatter is the product of uncontrolled fracturing, which tends to follow along lines of internal weakness. Note also that block shatter percentage is related to the specific reduction stage. This may be a function of selective cobble collecting geared to point production versus the manufacture of an expedient knife or chopper for which some degree of uncontrollable fracturing could be

PLATE M-3: Replicant Pebble Point with Associated Debitage, Catalog No. 9915

tolerated. The relationships among cobble size, mean flake weight, finished product, and block shatter occupy a node of correlation between attribute-based analysis and mass analysis and can be read as a rejection of Hypothesis 3, for cobble size and shape appear to be have been more important factors than the distance between cobble location and lithic workshop in the selection of raw material.

Aside from the association between block shatter and reduction stage, the only trait-based flake type from the replicant sample that exhibits an unequivocal relationship to the production sequence is the early reduction flake. Approximately 38 percent of the debitage generated by the replicant early-stage biface was coded as early reduction flakes, compared to 12 to 15 percent recorded for the other staged bifaces and flakes[1] are generally interpreted as by-products of later-stage reduction when the biface is thinned prior to final edge preparations. This flake type was most common among the replicant late-stage bifaces, accounting for about 33 percent of debitage by count, but only 24 percent for replicant points. This may be the result of sample bias or may reflect the somewhat larger mean cobble size used for the late-stage bifaces; small cobbles have less mass to remove to produce the intended tool.

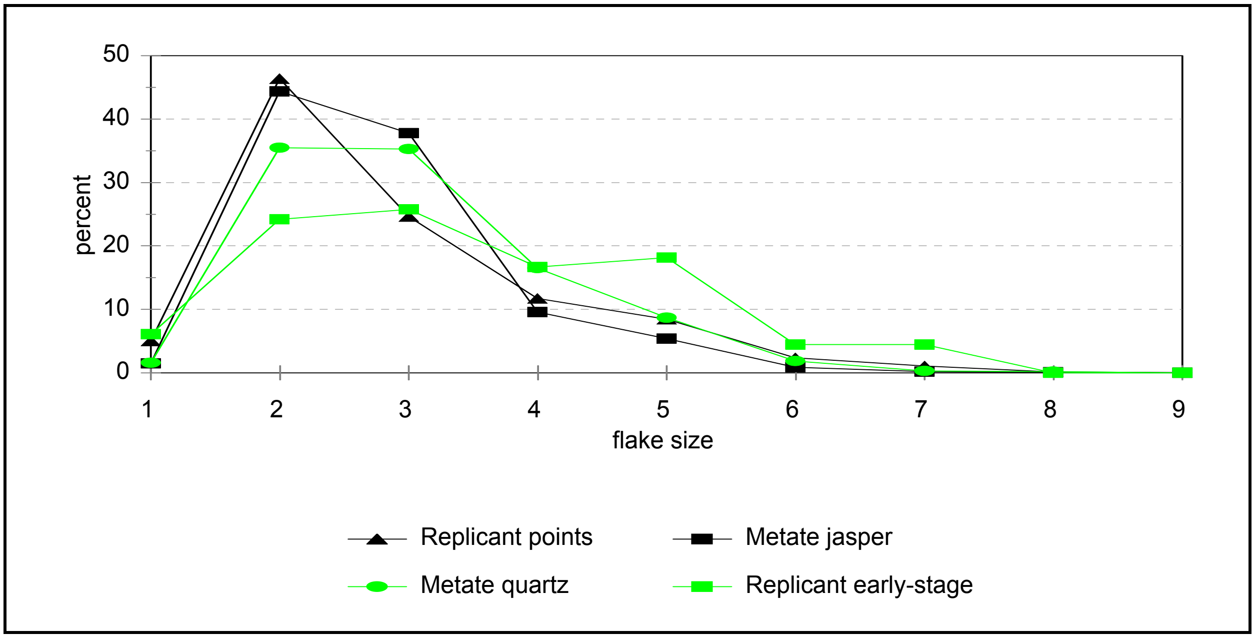

FIGURE M-3: Flake Size Distribution Curves for Replicant Points, Replicant Early-stage Biface, Metate Block Jasper Debitage, and Metate Block Quartz Debitage

IV. CONCLUSIONS

The program of projectile point replication was designed to elicit responses to a variety of concerns about the lithic assemblage recovered at the Puncheon Run Site. Among these concerns was understanding the process of pebble point manufacture and the strategies for lithic raw material procurement. Analysis of the replicated points and associated debris assemblage indicates that freehand reduction techniques can produce

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[1] *Biface Reduction Flakes* are intact or nearly intact flakes with multiple overlapping dorsal flake scars and small, elliptically shaped platforms with multiple facets. Platform grinding is usually present. Platforms are distinctive because they represent tiny slivers of what once was the edge of a biface.

tool forms very similar to those found in the archaeological assemblage. Although we cannot know how accurately the manufacturing process used to produce the replicants models the actual manufacturing technology of the archaeological sample, it is assumed that the replicants made with a free-hand technique are the "most suitable" models available.

Further, patterns of production failure among the replicants appeared to be linked to initial cobble size, with successful point reduction clustered among the smallest cobbles. This finding suggests that size optimization may have been an important criterion of cobble procurement, along with raw material selection and distance of transport. The small size of cobble cores may explain the very high rates of cobble cortex found among the archaeological point sample. While some researchers (B. Funk, personal communication 2000) view the retention of basal cortex on some point types as a possible cultural or stylistic marker, it is reasonable to assume that the origin of this practice had a technological basis.

The replication study was also designed to test the applicability of mass analysis for the classification of flake assemblages. In contrast to classification by formal flake attributes, mass analysis is an aggregate system of ordering reduction-generated debris by interval size-grades. Flake-size distribution curves obtained from replicant-generated debris appear to be good predictors of reduction stages represented by archaeological assemblages in the Metate block as assessed by the composition of associated toolkits.

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ATTACHMENT A

Puncheon Run Pebble Point Data
Puncheon Run Site (7K-C-51)

PUNCHEON RUN PEBBLE POINT DATA

Catalog Number	Provenience	Material	Cortex	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)
Locus 3, Feature 30 Block							
98/2/363	Unit 365, a-1	Chert	.	3.3	32.1	18.2	6.8
98/2/1381	Unit 488, b-3	Chert	.	3.5	28.9	19.2	6.7
Locus 3, Metate Block							
98/2/188	Unit 330, c-3	Quartz	Base	3.7	.	19.7	6.7
98/2/213	Unit 331, b-3	Jasper	Base	5.1	37	23.4	6.2
98/2/315	Unit 353, b-3	Jasper	Blade	6.9	47.1	20.1	9.6
98/2/849	Unit 356, f. 36, b-3	Jasper	Base	5.3	.	21.3	7.7
98/2/849	Unit 356, f. 36, b-3	Jasper	Base	3.8	.	21.1	7.7
98/2/953	Unit 362, f. 36, b-3	Jasper	Blade	3.5	31.6	18.7	6.5
98/2/510	Unit 374, b-3	Siltstone	.	4.6	40.4	21.2	7.7
98/2/470	Unit 382, b-2	Chert	.	8.5	50.4	20.6	7.6
98/2/470	Unit 382, b-2	Jasper	Base	7.3	42.4	23	8.9
98/2/911	Unit 387, f. 96, b-3	Jasper	.	2.5	.	16.1	7.7
98/2/911	Unit 387, f. 96, b-3	Jasper	Blade	2.9	28	19.5	5.9
98/2/506	Unit 391, a-1	Jasper	Base	4.6	38.1	18.5	7.6
98/2/543	Unit 403, b-2	Chert	.	7.5	40.9	20.1	9.7
98/2/604	Unit 407, b-2	Chert	Base	6.5	41.3	19.2	8.6
98/2/432	Unit 407, b-3	Chert	Blade	5.9	46.7	18.9	10.4
98/2/666	Unit 419, a-1	Jasper	.	4.7	37.2	16.8	9.6
98/2/781	Unit 421, b-4	Chert	.	7.3	50.6	19.3	8.1
98/2/787	Unit 423, a-1	Jasper	.	7.8	51	22	7
98/2/818	Unit 426, a-1	Jasper	.	5.3	32	20	9
98/2/831	Unit 427, b-5	Quartz	Base	6.9	36.3	22.9	9
98/2/912	Unit 429, a-1	Jasper	Base	7.6	.	23	7.8
98/2/913	Unit 430, a-1	Jasper	Base	3.8	30.5	18.3	7.3
98/2/1000	Unit 441, b-5	Jasper	Base	3.6	35	16.4	7.8
98/2/1004	Unit 442, b-4	Jasper	Base	3	.	.	7.9
98/2/1027	Unit 449, b-2	Jasper	Base	4.7	.	20.4	8
98/2/1186	Unit 459, a-1	Chert	Base	8.2	45.6	23.5	7.9
98/2/1186	Unit 459, a-1	Chert	Base	6.3	45.4	25.1	9.6
Locus 3, non-Area							
97/55/413	Unit 154, a-1	Jasper	.	5.3	37.1	17.6	7.7
97/55/482	Unit 169, a-1	Argillite	Blade/ Base	4.2	41.4	16.2	6.8

Catalog Number	Provenience	Material	Cortex	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)
98/2/178	Unit 327, b-2	Jasper	Base	4.8	41.2	23.3	6.1
98/2/241	Unit 337, f. 33, a-2	Jasper	Base	3.4	34.4	16.5	7.7
97/55/397	Ft. 3b, a-1	Jasper	Base	5.8	.	22.5	8.5
98/2/300	Unit 352, b-2	Jasper	Tip	8.2	49.6	22.5	9.9
97/55/18	General	Jasper	Base	4.4	35	18.4	8.4
97/55/20	General	Quartz	.	6.4	34	19.8	9.5
97/55/22	General	Chert	Base	7.7	41	20.6	11.1
97/55/62	General	Chert	Blade	10.4	48.6	20.2	12.1
97/55/167	General	Chert	.	5.7	35.5	22.2	7.7
97/55/167	General	Jasper	.	8.8	51.8	19.5	10.2
Mean				5.9	39.9	20.1	8.3
Standard Deviation				1.9	6.9	2.3	1.5
Maximum				10.4	51.8	25.1	12.1
Minimum				2.5	28	16.1	5.9

ATTACHMENT B

Summary Characteristics of Replicant Tools
Puncheon Run Site (7K-C-51)

SUMMARY CHARACTERISTICS OF REPLICANT TOOLS

Catalog Number	Tool Produced	Remarks	Production Statistics	
9902	chert middle-stage biface	tool rejected during manufacture because of internal cleavage	Tool measurements (mm)	
			length	55
			width	32
			thickness	21
			length:width	1.7:1
			width:thickness	1.5:1
			Weight (g)	
			cobble	110.0
			tool	32.2
			flakes	77.6
			microflakes	0.2
9903	jasper projectile point	stemmed point with basal cortex	Tool measurements (mm)	
			length	47
			width	23
			thickness	10
			length:width	2.0:1
			width:thickness	2.3:1
			Weight (g)	
			cobble	57.3
			tool	8.7
			flakes	45.0
			microflakes	3.6
9904	chert early-stage biface	tool rejected during manufacture because of block shatter of one pole	Tool measurements (mm)	
			length	NA
			width	27
			thickness	16
			length:width	NA
			width:thickness	1.7:1
			Weight (g)	
			cobble	172.1
			tool	24.1
			flakes	147.4
			microflakes	0.6
9905	jasper projectile point	stemmed point; basal cortex	Tool measurements (mm)	
			length	58
			width	23
			thickness	13
			length:width	2.5:1
			width:thickness	1.8:1
			Weight (g)	
			cobble	52.3
			tool	15.5
			flakes	32.3
			microflakes	4.5

Catalog Number	Tool Produced	Remarks	Production Statistics	
9906	chert late-stage biface	reduction halted as a result of step-terminated fracture mid-blade	Tool measurements (mm)	
			length	51
			width	30
			thickness	11
			length:width	1.7:1
			width:thickness	2.7:1
			Weight (g)	
			cobble	83.8
			tool	16.9
			flakes	66.5
			microflakes	0.4
9908	chert projectile point	stemmed point; basal cortex	Tool measurements (mm)	
			length	52
			width	24
			thickness	10
			length:width	2.2:1
			width:thickness	2.4:1
			Weight (g)	
			cobble	82.4
			tool	11.8
			flakes	68.9
			microflakes	1.7
9909	quartzite late-stage biface	cortex on blade; reduction halted as a result of step-terminated fracture mid-blade	Tool measurements (mm)	
			length	47
			width	29
			thickness	11
			length:width	1.6:1
			width:thickness	2.6:1
			Weight (g)	
			cobble	41.5
			tool	12.7
			flakes	28.0
			microflakes	0.8
9911	jasper late-stage biface	basal cortex; reduction halted as a result of step-terminated fracture mid-blade	Tool measurements (mm)	
			length	55
			width	33
			thickness	12
			length:width	1.7:1
			width:thickness	2.8:1
			Weight (g)	
			cobble	130.9
			tool	20.2
			flakes	105.3
			microflakes	5.4

Catalog Number	Tool Produced	Remarks	Production Statistics	
9912	chert middle-stage biface	broken during manufacture	Tool measurements (mm)	
			length	NA
			width	NA
			thickness	19
			length:width	NA
			width:thickness	NA
			Weight (g)	
			cobble	150.6
			tool	242.7
			flakes	119.7
			microflakes	6.2
9913	chert late-stage biface	basal cortex; knife form; split cobble; shared with Cat No. 9914	Tool measurements (mm)	
			length	56
			width	30
			thickness	9
			length:width	1.9:1
			width:thickness	3.3:1
			Weight (g)	
			cobble	133.9
			tool	14.1
			flakes	116.6
			microflakes	3.2
9914	chert projectile point	stemmed point; basal cortex; shared with Cat No. 9913	Tool measurements (mm)	
			length	63
			width	22
			thickness	10
			length:width	2.9:1
			width:thickness	2.2:1
			Weight (g)	
			cobble	62.0
			tool	11.5
			flakes	47.1
			microflakes	3.4
9915	jasper projectile point	stemmed point; basal cortex	Tool measurements (mm)	
			length	56
			width	29
			thickness	11
			length:width	1.9:1
			width:thickness	2.6:1
			Weight (g)	
			cobble	163.1
			tool	15.7
			flakes	
			134.1	
			microflakes	13.3

Catalog Number	Tool Produced	Remarks	Production Statistics	
9916	quartzite middle-stage biface	reduction halted as a result of multiple step-terminated fractures; raw material is brittle mid-blade	Tool measurements (mm)	
			length	73
			width	44
			thickness	16
			length:width	1.7:1
			width:thickness	2.8:1
			Weight (g)	
			cobble	193.3
			tool	47.7
			flakes	138.6
			microflakes	7.0

ATTACHMENT C

Lithic Analysis Data for Replicant Tools
Puncheon Run Site (7K-C-51)

LITHIC ANALYSIS DATA FOR REPLICANT TOOLS

	Catalog Number													
Type	9902	9903	9904	9905	9906	9908	9909	9911	9912	9913	9914	9915	9916	**Totals**
Debitage														
<6 mm	1	11	4	8	5	5	2	4	14	6	4	32	10	106
6-10 mm	10	82	16	85	25	89	34	86	86	92	91	203	81	980
11-15 mm	12	40	17	34	22	44	24	46	52	57	41	83	49	521
16-20 mm	11	12	11	10	18	20	23	17	17	26	21	45	17	248
21-30 mm	7	11	12	9	11	14	5	16	18	16	23	21	16	179
31-40 mm	2	7	3	3	4	3	1	5	4	1	3	5	9	50
41-50 mm	4	.	3	.	1	.	.	3	4	1	.	4	3	23
51-60 mm	.	.	.	.	.	.	.	.	.	3	.	.	1	4
>60 mm	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Subtotal	47	163	66	149	86	175	89	177	195	202	183	393	187	2,112
Biface Reduction	19	41	16	33	33	76	25	58	33	65	54	60	44	557
Block Shatter	7	2	6	6	2	1	1	5	23	7	2	26	2	90
Decortication	5	7	4	15	14	17	22	17	24	10	15	36	24	210
Early Reduction	3	33	25	31	10	16	4	22	16	40	26	58	31	315
Flake Fragments	13	70	13	53	22	65	22	66	85	68	55	136	73	741
Flake Shatter	.	2	2	6	5	.	1	7	11	8	23	55	13	133
Pressure Flakes	.	8	.	5	1	.	14	2	3	4	8	22	.	67
Subtotal	47	163	66	149	86	175	89	177	195	202	183	393	187	2,112
Resultant Tools														
Early-stage Biface	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Middle-stage Biface	1	.	.	.	.	.	.	.	1	.	.	.	1	3
Late-stage Biface	.	.	.	.	1	.	1	1	.	1	.	.	.	4
Projectile Point	.	1	.	1	.	1	.	.	.	.	1	1	.	5
Freehand Core	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Subtotal	1	1	2	1	1	1	1	1	1	1	1	1	1	14
Totals	48	164	68	150	87	176	90	178	196	203	184	394	188	2,126