LITHIC ARTIFACTS FROM THE MALEIMI VALLEY
A LEE SPENCER ARCHEOLOGY
LITHIC ANALYSIS
LEE SPENCER ARCHEOLOGY LITHIC ANALYSIS

One hundred twenty-five artifacts were examined from the Maleim Valley. Only ten of these artifacts were tool/perform artifacts. I was contacted and asked to do a simple of identification analysis of the debitage and tools present. This has been completed and is documented herein. Section 1 contains the debitage analysis, section 2 contains the tool and perform artifact analysis, and section 3 contains the procedures used, a glossary of terms, and a bibliography pertaining only to the analytic procedures used.

Note that these procedures are of questionable utility in deriving behavioral information from the debitage artifacts. Previous work on site materials from American Samoa has strongly and clearly suggested that debitage analysis based on the standard North American system of flake dorsal side cortex classification is inappropriate and misleading (see Spencer 1995 supplementary notes pp. 50-52 in Ester 1995 [I have never been supplied the bibliographic reference for this document]). Unfortunately, a collection of the size of these Maleim Valley artifacts is highly unsuitable for coming at a more suitable system relevant to Samoan artifact assemblages.

SECTION 1

DEBITAGE ANALYSIS

ABBREVIATIONS

In the tables herein dealing with the debitage artifacts from the Maleim Valley site, AS-3134, the following abbreviations will be used

AW=angular waste
NPRX=nonproximal flake fragments
PRX=proximal flake fragments
I=primary cortex flakes
II=secondary cortex flakes
III=tertiary flakes.

Note: the cortex debitage classes are a subclass of the whole flake fragmentation debitage class. Therefore, the total represents the sum of the fragmentation classes without reference to the cortex classes

The use of the term facet in parentheses after a flake means it contains a ground facet or facets.
Table 1. Basalt debitage artifacts from Unit 1 at AS-31-34 in the Maleimi Valley.

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<th>PRX</th>
<th>WHOLE</th>
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<th>(III)</th>
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TOTAL: 1  2  1  1  1  3

Comments on Unit 2 debitage: whole flake from Level 4 contains rounded edges
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TOTAL  | 1  | 3   | 1   | 2    | 1   | 1    | 1     | 7      |

Comments on Unit 3 debitage: whole flake from Level 7 is large and angular.
Table 4. Basalt debitage artifacts from Unit 3X at AG-31-34 in the Malemi Valley.

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Table 6. Basalt debitage artifacts from Unit 5 at AS-31-34 in the Malaeimi Valley.

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Table 7. Basalt deblitage artifacts from Unit SX at AS-31-34 in the Malesi Valley.

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TOTAL 1 1 1 2
Table 9: Basalt debitage artifacts from Unit 7 at AS-31-34 in the Maleimi Valley

Debitage Fragmentation Classes

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TOTAL: 1 1 6 6 8

Comments on Unit 7 debitage: one of the whole flakes from Level 7 contains the platform/dorsal edge of a core or adze as a dorsal guiding ridge.
Table 10. Basalt debitage artifacts from Unit 7X at AS-31-34 in the Malemi Valley.

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Comments on Unit 7X debitage: Two apparently nonartifactual pieces of obsidian were recovered from Levels 6 & 7 of this unit.
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Table 12. Basalt debitage artifacts from Unit 7W, Quad B, at AS-31-34 in the Malemi Valley.

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Comments on Unit 7W, Quad B, artifacts: whole flake from Level 3 is an adze manufacture flake (see note at end of tables).
Table 13. Basalt debitage artifacts from Unit 9 at AS-31-34 in the Malemi Valley.

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Table 14. Basalt & obsidian debitage from Unit 10 at AS-31-34 in the Maleimi Valley.

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7 (one is obsidian)
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Table 17. Basalt debitage artifacts from Unit 14 at AS-31-34 in the Maleimi Valley

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<tr>
<td>6</td>
<td>1</td>
<td>3</td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>25%</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>
Table 18: Basalt debitage artifacts from Probe B at AS-31-34 in the Malemi Valley.

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>AW</th>
<th>NPRX</th>
<th>PRX</th>
<th>WHOLE</th>
<th>(I)</th>
<th>(II)</th>
<th>(III)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>surface n</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>100%</td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
NOTES ON ADZE MANUFACTURE FLAKES

Large, thin, relatively-flat flakes containing dorsal flake scars which were removed from a direction directly opposite to that that the flake itself was removed from appear to be adze manufacture flakes. There are not a lot of this type of flake in this collection, however they are present. The diagnostic criteria seem to be flatness and the presence on the distal portion of the dorsal side of the flake of an edge from which flakes were removed toward the platform of the flake in question. This is not evidence of a bipolar reduction technology because the contrary flake scars are confined to the dorsal surface of the flake.

Potentially, any large relatively-flat flake may represent adze manufacture.
SECTION 2

TOOL AND PREFORM ANALYSIS

ABBREVIATIONS

In the tables herein dealing with the tool and preform artifacts from the Malemi Valley site, AS-31-34, the following abbreviations will be used:

Cat # = catalogue number
WE = working edge
D = dorsal side
d = distal end
l = left
r = right
le = lateral edge
p = proximal
prj = edge projection
I = primary cortex flake
ll = secondary cortex flake
lil = tertiary flake
trap = trapezoidal
quad = quadrilateral
triang = triangular.
Basalt tool and perform artifacts artifacts from Unit X at AG-31-34 in the Malemi Valley.

RETOUCHED BASALT ARTIFACTS

<table>
<thead>
<tr>
<th>Cat #</th>
<th>Unit</th>
<th>Level</th>
<th>Fragmentary</th>
<th>Artifact</th>
<th>Number</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>3x.001</td>
<td>3x</td>
<td>3</td>
<td>complete</td>
<td>flake</td>
<td>1</td>
<td>Dd proj</td>
<td>scraper</td>
</tr>
</tbody>
</table>

--This is a UNIFACIALLY RETOUCHED ARTIFACT. The ventral surface shows patterned striations running somewhat oblique to the long axis of the flake. Artifact contains some rounding that obscures retouch scars. Steps appear to be present on the working edge.

3.001? | 3?   | 2     | fragmentary | ill? flake | 1      | Dlat     | scraper  |

--This is a UNIFACIALLY RETOUCHED ARTIFACT. It is a medial flake fragment containing only one parent flake edge. Fracture faces intersect the working edge at either end making it incomplete. Stepping is present on the working edge.

5.006 | 5    | 1?    | Complete    | nodule    | --     | --       | core?    |

--This has the look of a haphazard artifact. The outer face/platform edge and scars look accidental. It appears to have been heat altered, again possibly accidentally. There is one flake scar on the other side of the nodule. This is possibly a tested nodule/core preform that was discarded.

3.004 | 3?   | 3?    | Complete    | flake     | 3a     | Dl proj  | backing? |

b  Dl  slicing
c  Dl  backing?

--This is a BIFACIALLY RETOUCHED ARTIFACT (a FLAKE BIFACE). The flake is twice as wide as it is long. Other than those projections altered by backing retouch, the remaining projecting portions of the artifact's edges are naturally dulled by cortex.

**Working edge (WE) 3a** is a bifacially retouched projection that is covered by invasive scars that are interpreted as backing (see procedures section herein).

WE 3b is the longest edge of the artifact and is slightly convex in shape. Retouch consists of contiguous and non-contiguous bifacial nibbles. It is possible that WE 3b nibbles represent use-wear and not retouch. This collection is to small to systematically address the use-wear versus retouch issue as it applies to the alteration present on the working edges in question.

WE 3c retouch incorporates the dorsal left platform corner and consists of non-contiguous unifacial nibbles.

<table>
<thead>
<tr>
<th>Cat #</th>
<th>Unit</th>
<th>Level</th>
<th>Fragmentary</th>
<th>Artifact</th>
<th>Number</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.009</td>
<td>3</td>
<td>4?</td>
<td>fragment</td>
<td>ill flake</td>
<td>1</td>
<td>Vlat</td>
<td>unknown/backing?</td>
</tr>
</tbody>
</table>

--This is a BIFACIALLY RETOUCHED ARTIFACT (a FLAKE BIFACE). WE ventrally consists of contiguous unifacial retouch with stepping; however, dorsally along the same portion of edge there are a few invasive, contiguous retouch scars. This is a fragmentary artifact and the portion of the flake that may have contained signs of use or retouch (or both) is not present.
Working Edge Attributes

<table>
<thead>
<tr>
<th>Cut #</th>
<th>Unit</th>
<th>Level</th>
<th>Fragmentary</th>
<th>Artifact</th>
<th>Cross- Section</th>
<th>Plan- Section</th>
<th>Facets</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.012</td>
<td>5</td>
<td>4</td>
<td>Fragmentary</td>
<td>Ill flake trap</td>
<td>subquad</td>
<td>0</td>
<td>Adze preform</td>
<td></td>
</tr>
</tbody>
</table>

- This artifact is extremely simple in form, looking like nothing so much as a longitudinally broken flake with a unifacial working edge on the opposite flake edge. Attention to the longitudinal break clarifies that it consists of at least two probably purposeful flake scars. The obvious unifacial retouch on the ventral left lateral edge and incorporates part of the ventral left distal corner. There is stepping on this retouched edge. Some rounding obscures the flake scars, but it is possible that larger, invasive flake scars underlay this unifacial retouch.

The apparent break on the ventral right lateral portion of the preform is composed of two flake scars in excess of 2.0 cm wide. The edge projection formed by the intersection of these two flake scars has been modified by two to three smaller scars.

8.028 | 7X   | 2?   | Fragment? | ? | -- | 3+ | Adze fragment |

- This artifact is the lozenge shaped fragment of a potentially thin adze and contains three ground facets, one of which is only a few mm wide and forms a cutting edge? There is bilateral flaking along half of this latter cutting edge.

8.027 | 7X   | 5?   | Complete | ? | trap | subtriang | 8 | Type III Adze |

- This artifact is rounded and the facet edges are obscured, but it appears there are eight facets. It has a fully ground finish. There are long impact fractures on three of the four cutting edge corners and there are two of these fractures on the cutting edge itself. This cutting edge is straight. The poll end of the adze also has a number of flake scars that may have been produced during use.

7X.001 | 7X   | complete | ? | triangled quad | 0 | Adze preform |

- This is possibly a type VIII adze. The surfaces of the adze appear to be fully formed though there are no ground facets. Flaking appears irregular; however, the lateral and the cutting edges are relatively even.

*on wall rocks next to Unit 7X* [written on tag with artifact].

8.025/ | 7X   | surface | ** (see note below**) | trap | 4 | Adze fragment reused as a unifacially retouched working edge. |

This artifact contains two numbers the second of which is 7X.001

- This artifact appears to be a use-broken adze of unknown type which has served as the parent artifact for a convex UNIFACIALY RETOUCHEP WORKING EDGE. As such this unifacial edge should be counted with the unifaces documented elsewhere in this analysis.

** There is a unifacial working edge that has been formed on the adze after it broke. The broken adze is thus the parent artifact of the unifacial working edge and must be considered to be complete. The adze itself is fragmentary and appears to have been broken during use, perhaps while bound in a har.
LEE SPENCER ARCHEOLOGY
LITHIC ANALYSIS

SECTION THREE

PROCEDURES

INTRODUCTION

This report presents a complete description of the procedures used during the analysis of the lithic artifacts from the site. It is a lengthy section because, generally, there are more than two ways to tie any fly that I know of. Even so apparently simple a procedure as the measurement of length, width, and thickness on flakes or tools varies according to historic period, training, and theory. As an example, twenty-two years ago at my undergraduate institution (U.C. Berkeley) the length measurement of a flake was simply that artifact's longest dimension with no regard to flake morphology. The verifiability of analytical results as well as any pretense of scientific methods necessitates a thorough presentation of procedures. I have also presented statements of assumptions and biases, in-so-far as I am aware of them.

The procedures presented form a complete, internally consistent analytic system. Statements and definitions are phrased in the form of general rules. Exceptions to each of these rules do exist; however, it is my contention that--except in specialized cases--the statements hold true in so much the majority of cases that any exceptions prove the rules as stated. A similar analytical system was used in the Time Square Rockshelter report and the debitage analysis of the Elk Creek Lake sites and the Owl Canyon site (Spencer 1989, 1987, 1981, respectively). The reader is directed to the glossary of terms at the end of the text for the clarification of unfamiliar terminology.

First to be discussed are the various debitage types, followed by the tool/preform types. Of the tool/preform types the first to be discussed will be the unretouched tools, followed by the cores, then the unifacially retouched artifacts, and, finally, the bifacially retouched artifacts. As a final proviso I note that in the discussion of analytic procedures to follow, some artifact types may be mentioned which may not have been recovered from this site. See the actual analysis for a discussion of the artifacts recovered from the site.
THE LITHIC DEBITAGE

Debitage from the site was first sorted into various material types to be detailed below. The flakes were then sorted descriptively and functionally. The final stage of this analysis involved sizing certain of the categories of flakes.

MATERIAL

In the analysis CCS, obsidian, and basalt were observed.

MEASUREMENT OF SIZE

The size of diagnostically complete flakes is determined using 11 non-concentric circles of graduated sizes from 5.0 to 50.0 mm in diameter. These circles are graduated in 5.0 mm diameter increments except for a 7.5 mm diameter circle. Any contact with the perimeter of a circle places a flake in the next larger size class regardless of how minute that contact is. Proximal fragments are also sized, however a plus sign (+) is added to the measurement. Any flake larger than would fit in the 50.0 mm diameter circle is listed by its actual length in millimeters--length being measured along a straight line from the point of contact, through the ripple centers, to the termination. While proximal flake fragments were sized they are not included in the calculation of mean size presented for the various debitage groups in this report.

THE DESCRIPTIVE AND FUNCTIONAL DEBITAGE TYPES

The debitage analysis is designed to be both descriptive and functional. All flakes are initially analyzed descriptively, separated into one of several categories which include heat spalls, angular waste, non-proximal flake fragments, proximal flake fragments, and whole flakes. Subsequent to the descriptive identification of the debitage, proximal flake fragments and whole flakes are functionally identified as well. On the actual debitage analysis tabulation sheets, the distinction between proximal fragments and whole flakes in the functional categories is maintained so that sizes for debitage reported, herein, refer solely to whole flakes.

Five functional debitage types are identified for the debitage: core preparation flakes, core reduction flakes, proximal edge preparation flakes, biface tool manufacture flakes, and simple platform tool manufacture flakes.

Not all descriptively identified flakes can be functionally identified. In these LSA procedures, a formal set of morphological attributes exists by which the functional categories of debitage are uniformly identified. When a flake does not exhibit these attributes it is designated as other debitage.

The procedural definition of the debitage types and keys for their identification are presented below.
THE DESCRIPTIVE DEBITAGE TYPES (see Figure 1.1)

See Spencer 1986 for an initial use of many of the following debitage artifact descriptions.

Heat Spall. A heat spall has a polygonally-circular plan view and a planoconvex transverse cross-section. The relatively flat dorsal side is made up of any type of flake surface (including a surface containing one or more heat spall scars). The convex ventral surface is the positive representation of the heat induced fracture which is initiated and propagates from the center of the fracture surface as opposed to being initiated from one end as is the case with flakes. A heat spall is commonly thickest at the center and thins toward all edges. The ventral surface of a heat spall is variably faceted and the intersection of the facets forms minor, radially oriented ridges.

When this artifact deviates from a circular plan view, it is generally because the heat spall incorporates a marked ridge on the artifact surface it was removed from. The positive surface of a heat spall is different from yet equivalent to the ventral surface of a flake which is also a positive fracture surface. The positive heat fracture surface referenced is not the crazed or a cracked surface common with some types of heated material.

Heat spalls are most common with CCS materials and occasionally basalt too. Because a non-cultural piece of raw material can be fractured by a natural, or wild, fire, a heat spall will not at all times represent cultural activities. It is context that will generally determine whether a heat spall is cultural or not.

Angular Waste. Angular waste exhibits neither a ventral flake surface, a positive heat spall surface, nor retouched surface.

This artifact may also be non-artifactual, or a by-product of the random natural introduction of force into a non-cultural piece of lithic raw material. As with heat spalls, it is the specimen's context and other features which will determine whether it is cultural and an artifact or not.

Flake. A digression: each of the remaining three descriptive debitage types is a cultural, or artifactual, flake or a flake fragment. A few comments on artifactual flakes are therefore necessary. The mechanical principles of the fracture process are the same whether the fracture is induced by a natural agency or a cultural agency. Those attributes which are generally considered to be diagnostic of a cultural flake are a by-product of the nature of the objective piece the flake is removed from and the angle of force introduction in relation to the outer face of the objective piece, as well as, the positioning of the point of force introduction in relation to the edge of the objective piece (see the glossary, herein, for a definition of unfamiliar terms).
Force may be naturally introduced into a piece of noncultural lithic raw material and produce a flake that exhibits those features common to culturally produced flakes. This fortuitous introduction of force may occur in a scree slope, an alluvial fan, or the bed of a stream. Because of this context again comes into play, context and probability.

Cultural flakes exhibit the following features: (definitions of italicized words in this section will be found in the glossary) a platform which may contain a lip or node; a ventral surface with a point of contact, a bulb of force, waves, ripples, and fissures—all represented positively, as well as, possibly an erasure scar, a dorsal surface containing the same features (not including the erasure scar) all represented negatively in whatever flakes scars or portions of flake scars are present. Cortex may be present on the platform and on the dorsal flake surface, as well. Each of these surfaces will intersect the others. These surfaces with their features are angled in relation to each other and specifically shaped due to an introduction of force into a relatively flat platform of an objective piece (such as a core) close to an edge which forms an angle of less than 90 degrees with an outer face, generally over a guiding ridge. Finally, the platform of a flake is the proximal portion and the termination of a flake is herein and elsewhere considered the distal end.

**Non-Proximal Flake Fragment.** A non-proximal flake fragment does not contain an identifiable platform. Lateral fragments are included in this category.

**Proximal Flake Fragment.** A proximal flake fragment contains the platform.

**Whole Flake.** A whole flake is either nonfragmented or has less than 20% of a fine, feathered edge missing.

**THE FUNCTIONAL DEBITAGE TYPES**

Functional debitage types are procedurally defined and assigned a clearly identifiable set of attributes. On inspection, should a debitage type show itself to be at variance with the defined types, this variance will be documented.

The analysis of the tools and preforms will supply data critical to the design of the debitage analysis and so, if possible, tools and preforms should be analyzed first. For example, the determination of the size of the flake scars on the outerface of cores from a component will give a minimum size to be expected for core reduction and core preparation flakes of the same material, other things being equal; or the circle-sizing of complete tools (including unretouched tools) will produce complementary data. The size of the flake scars on unifacial and bifacial tools and preforms will yield useful size data that can be correlated with tool manufacture debitage. Sufficient parent artifact surface on tools or on preforms to identify the flake.
type chosen for retouch—if made on a flake—will yield morphological data
about the features common to the core reduction flakes in the relevant
reduction sequence.

VENTRAL FLAKE SURFACE

OBSERVED
  ↓
  POSITIVE HEAT SPALL SURFACE
  NO  YES
  ↓  ↓
  ANGULAR  HEAT WASTE SPALL

COMPLETE OR SHATTERED PLATFORM PRESENT
  ↓
  NO
  ↓
NON-PROXIMAL FRAGMENT

MORE THAN 1/5
OF A FINE FEATHERED EDGE MISSING
YES  NO
↓  ↓
PROXIMAL FLAKE FRAGMENT  WHOLE FLAKE

FIGURE 1.1. DESCRIPTIVE DEBITAGE KEY.

In the description of the specific functional flake types given below will
be found minimum circle-sizes that have been found useful in other lithic
analyses. Note that any debitage analysis, whether done before or after the
tool preform analysis, will yield heretofore unrecognized tools and preforms.

CORE PREPARATION FLAKES (CP)
Definition. A core preparation flake is a by-product of core manufacture activities. All cores have certain features which—if not present on the objective piece chosen for use as a core—generally need to be produced, or manufactured, prior to the effective use of that piece as a core. Such an objective piece, be it a raw material nodule, a flake, or another artifact type, requires the preparation of a relatively flat platform surface which forms an angle with an outerface of less than 90 degrees. A convex platform outer face edge and an outerface surface containing guiding ridges also needs preparation. Core preparation flakes produce these core features. Occasionally some of these core features need to be rejuvenated during the production of core reduction flakes. Note that any artifact may become a core as long as it is large enough to produce the flake size required. This will sometimes be reflected in quite unusual core preparation flakes.

Description. These flakes are 15.0 mm in size or larger. Their dorsal sides contain some cortex. If this cortex makes up less than 25% of the dorsal surface area and is distally located contiguous to the termination then the flake is not a core preparation flake, but is a core reduction flake. This distinction is made to allow for a small amount of cortex on the bottom of the core after it has been prepared—a common situation. In such a circumstance, a flake that is otherwise free of cortex might pick up a small amount of this bottom cortex just before it terminated.

The amount and the location of the cortex on the dorsal side of these flakes will distinguish CP flakes from core reduction flakes. Dorsal surface cortex and wide, thick, simple or cortex platform surfaces and dorsal or central flake planes will distinguish CP flakes from tool manufacture flakes. Note that this procedural description identifies all primary and secondary cortex flakes of 15.0 mm or larger in size as core preparation flakes.

Note—presence or absence of cortex on a flake’s platform has no bearing on the inclusion of a flake in this or any other of the functional flake types in this analytic system. All cortex on a platform means is that the core contained a cortex platform.

PROXIMAL EDGE PREPARATION FLAKES (PEP)

Definition. These flakes are removed during the modification of the proximal portions of the dorsal guiding ridges on a core. The proximal portions of the negative flake scars—where they intersect on the platform/outerface edge of the relevant objective piece—produce pronounced overhangs (see Crabtree’s definition 1 for the term lip 1972:74). The uniform propagation of introduced force is enhanced if these overhangs are removed. The more pronounced bulbs of force associated generally with core preparation and core reduction flakes necessarily produce more prominent overhangs (see Spencer, Appendix G, in Pettigrew and Lebow 1987).
Description. These flakes have platform dorsal angles >45 degrees. The maximum width and thickness is in the platform. Dorsal ridges are few, quite pronounced, and are generally centered. Platforms have simple or cortex surfaces and central to dorsal flake planes. The dorsal surface of these flakes may have cortex or highly angular surface with guiding ridges measuring >45 degrees.

CORE REDUCTION FLAKES (CR)

Definition. Core reduction flakes are those flakes removed from all cores subsequent to the completion of core preparation which are to be used as unretouched tools or are manufactured into other types of tools. The production of this type of flake is the task of the core, just as the task of a scraper may be to clean milkweed fiber prior to making cordage. The size of the core reduction flake is related to the size of the intended tool. Core reduction flakes for tools requiring a great deal of retouch necessarily need to be larger than those intended for minimally retouched or unretouched tools, other things being equal.

Description. These flakes are 15.0 mm in size or larger. Their dorsal sides have totally interior surface or will contain no more than 25% cortex located distally contiguous to the termination. They will be regular in shape; that is, they will have guiding ridges which are reasonably straight for most of the length (or width) of the flake and at least one edge, lateral or distal, which is straight or smoothly and slightly concave or convex.

The absence of cortex or, when present, the amount and the location of cortex on the dorsal side of the flake distinguish these flakes from core preparation flakes. The simple, wide, thick platforms which have central to dorsal flake planes and platform dorsal angles greater than 45 degrees will generally distinguish these flakes from biface tool manufacture (BTM) flakes. This latter difference will not necessarily be valid if the cores contain bifacial platforms cores.

Note—presence or absence of cortex on a flake’s platform has no bearing on the inclusion of a flake in this or any other of the functional flake types in this analytic system. All cortex on a platform means is that the core contained a cortex platform.

BIFACE TOOL MANUFACTURE/REJUVENATION FLAKES (BTM)

Definition. A tool manufacture flake is a by-product of manufacturing or rejuvenation activities. A biface tool manufacture (BTM) flake is the by-product, or waste, of intentional bifacial edge modification whether this retouch is invasive or confined to the edge.

Description. These flakes will occasionally have continuous lips and platform dorsal angles of less than 45 degrees. Platforms are narrow and thin, have ventral flake planes, and have modified or multifaceted platform surfaces. Dorsal sides have guiding ridges >130 degrees, when measured perpendicular to the axis of the ridge. Occasionally, original flake surface
and contrary flake scars will be present on their dorsal surface. The dorsal sides will also commonly have two to five flake scars excluding proximal ridge preparation. Proximal ridge and platform preparation is quite common if not the rule with these flakes and is composed of quite small flake scars often with a fair amount of stepping. Most of these proximal ridge preparation flakes associated with BTM flakes will pass through a 1/8 inch screen.

KEY TO FUNCTIONAL DEBITAGE

This key is designed to be used as an adjunct to debitage analyses where no prior tool and preform analysis has generated data relevant to the debitage, where the relevant components and reduction sequences contain no bifacial platform cores nor is cortex present on significant proportion of tool and preform parent artifacts. Whole flakes only are to be analyzed.

1. 15 mm or more is size (circle-sizing) ............... CP, PEP, CR
   15 mm or smaller in size (circle-sizing) ............. STM
   Size Irrelevant ........................................ BTM

2. Platform with central to dorsal flake plane ...... CP, PEP, CR
   Platform with ventral flake plane .................... BTM

3. Platform contains continuous lip ..................... BTM

4. Platforms modified or multifacetted ................. BTM
   Platforms simple and flat ............................. STM, CP, PEP, CR

5. Platforms relatively narrow ............................ BTM

6. Dorsal surface cortex present ....................... CP, PEP, CR
   Dorsal surface cortex absent ......................... BTM, STM, CR, PEP

   Less than 25% dorsal surface cortex distally located
   contiguous to the platform ............................ CR

BTM=biface tool manufacture flake, CP=core preparation flake, CR=core reduction flake, PEP=platform edge preparation flake, STM=simple platform tool manufacture flake

SIMPLE PLATFORM TOOL MANUFACTURE/REJUVENATION FLAKES (STM)

Definition. A simple platform tool manufacture/rejuvenation flake is produced when an unretouched surface of a flake is used as a platform during the removal of retouch flakes. This type of flake is produced during the manufacture/rejuvenation of unifacial working edges and during the initial stages of biface manufacture.
Description. These flakes contain a flat, simple platform and a circle size of 15.0 mm or smaller. The significance of the term flat platform in this definition is to distinguish this surface from the simple but markedly concave surface of some BTM flakes. Platform flake plane and dorsal angle are variable.

OTHER DEBITAGE (OD)

Definition. Other debitage are those flakes which are not functionally identifiable.

Description. These flakes are cortex and interior flakes which are less than 15.0 mm in size and are not biface tool manufacture/rejuvenation flakes.

ANALYTICAL CONSIDERATIONS
AND THE ANALYST’S BIAS

Under this subheading are described assumptions, biases, and theoretical underpinnings of this analytic system.

THE BIFACE BIAS

Care is taken in this report to avoid what is herein referred to as the biface bias (Spencer 1989:370). Biface bias is the tendency to identify bifacial tool manufacture/rejuvenation as the most important reduction activity at a site when solely using frequency comparisons of lithic artifact types, debitage and preform/tool types, for interpretive purposes.

There are three principal reasons why lithic analyses are biased toward the identification of biface manufacture/rejuvenation as the primary activity in a site component where biface manufacture and rejuvenation occurred. One is that the manufacture of bifacial tools results in the production of many times the amount of debitage than does the break up of cores or the manufacture of unifacial tools. A second reason is that broken and discarded biface preforms are much more common because they are more thoroughly retouched with more chances of breakage than are uniface preforms, other things being equal; they are also more easily differentiated from the finished tool than are uniface preforms. The final reason is that the smaller debitage commonly resulting from the manufacture/rejuvenation of bifaces is less likely to be fortuitously chosen as the parent artifacts of tools than are those flakes removed from cores. Each of these reasons helps to make the relative amount of biface manufacture/rejuvenation debitage greater than other generic debitage types.

For the technological reasons indicated above it should be apparent that a one to one relationship does not exist between the frequency and the importance of lithic debitage and preform/tool types. In this report,
assessing the importance of the various lithic reduction activities relies on more than simple frequency comparisons.

Cortex and Function

An assumption used in this analysis is that cortex flakes were not removed from cores for the purpose of becoming parent artifacts of retouched tools. This may prove not to have been the case; if so, this situation will be clarified. The use of this assumption allows us to remove cortex flakes from the tool manufacture categories in the absence of other diagnostic criteria. Note, however, that cortex flakes may be used as the parent artifacts of non-retouched tools without affecting this assumption.

The Surfaces of a Man-Made Flake

One of the premises of this analysis is that unbroken and unretouched man-made flakes have three distinct surfaces. These are the dorsal surface, the ventral surface, and the platform. Each of these surfaces has its own set of features and two distinct edges formed by its intersection with the other two surfaces (Spencer 1981). The platform is the remnant of the objective piece or core platform; the dorsal surface is the remnant of objective piece outerface; and the ventral surface is the new surface produced in the removal of the flake—it is the positive representation of the fracture force which separated the flake from its objective piece.

The ventral surface features of a man-made flake are a point of contact, a bulb of force, waves, ripples, and fissures, all of which are represented positively. The ventral surface may have, as well, an eraillure scar. An eraillure scar is a small flake scar (s) which is sometimes present on the proximal half of the positive bulb of force and which propagates laterally from one of the pronounced fissures associated with the point of contact. The dorsal surface contains only what features were present on the outerface of the objective piece. These are cortex, flake scars, or both in some sort of configuration. When present, each flake scar will have any or all of the features mentioned for the ventral surface, only represented in negative. Eraillure scars will not, of course, be present in a negative flake scar. Most of the time, there will be ridges present on the dorsal surface that are usually formed by the intersection of two flake scars. Commonly, one or more of these ridges guided the propagation of introduced force that produced the flake in question. These guiding ridges will have controlled the propagation of force and, thus, the morphology of the flake, most noticeably, the outline of the lateral margins. These ridges will have influenced ventral flake features as well; in this case, most noticeably, the greatest number of fissures on the ventral surface will be found along the lateral edge farthest from the dominant guiding ridge. Guiding ridges need not be interflake crests but may be natural ridges composed of cortex or other ridges.

The platform surface contains only those features present on the platform of the objective piece prior to the removal of the flake. This flake
surface is the portion of the objective piece platform to the outside of the induced fracture. Because the purpose of a platform is simply to receive introduced force, flake platform features are commonly few. Platform shape is fairly uniform. The platform-ventral edge will be smoothly convex with possibly a centrally located node and the shape of the platform-dorsal edge will be whatever the platform-outerface edge of the objective piece was. Generally, the platform-dorsal edge shape will be influenced by the way in which the dorsal ridges connect with the platform and this itself will be influenced by the amount of preparation performed on that edge prior to the flake’s removal. The angle formed by the dorsoplatform intersection is virtually always less than 90 degrees.

The edge formed by the intersection of the platform and the ventral surface is convex and occasionally overhangs the ventral surface. When this overhang is continuous and uninterrupted from one platform-dorsavelventral corner to the other, it has been termed a lip in the literature (Shafer 1969:4; Crabtree 1972:74; Spencer 1981:30). This continuous lip is commonly associated with a more gentle introduction of force oriented toward the center of mass of the piece. Continuous lips are commonly associated with soft hammer percussion or pressure (Crabtree 1972:74; Spencer 1981:30).

The edge formed by the intersection of the ventral and dorsal surfaces at the distal end of the flake is called the termination. When this edge curves up onto the dorsal side, the termination has been termed a hinge in the literature (Crabtree 1972:68, Spencer 1987:122).

The edge formed by the intersection of the dorsal and the platform surfaces is convex from platform corner to platform corner with irregularities where dorsal ridges intersect with this edge. The removal of a flake from the center of a platform-outerface edge concavity, the removal guided by two widely spaced and roughly parallel guiding ridges, will produce a parallel-sided flake that is relatively thin and contains a platform that is meniscus shaped in plan view. This type of flake is variably common depending on the industries represented in the reduction sequences and components at a site.

A final aspect of the surfaces of a flake to be mentioned is curvature. From proximal to distal end the ventral surface is concave, from side to side it is convex. The end to end concavity of the ventral side is composed of the sinuosities formed by the bulb of force, the waves, and the quite small ripples. The dorsal side is convex end to end and variably convex side to side. Where the dorsal side is composed of flake scars each scar is a concavity and the intersection of scars forms a ridge. The platform surface is usually relatively flat or very slightly concave.

**OBJECTIVE PIECE MORPHOLOGY AND FUNCTIONAL DEBITAGE**

Directly or indirectly it is the morphology of the objective piece that determines what a flake will look like. The nature of the force introduced,
including the angle of force delivery, proximity of force introduction to the platform/outerface edge, and the amount of force, also influence flake shape.

Functionally different flakes will be more or less easy to differentiate based on how morphologically distinct the relevant objective pieces are. For example, biface tool manufacture flakes can generally be relatively easily distinguished from core preparation flakes because cores are usually quite morphologically distinct from bifacial slicing tools or projectile points or their preforms. This is so even when cortex is discounted. Biface tool manufacture flakes removed from a projectile point preform close to completion and biface tool rejuvenation flakes from a use-damaged projectile point in the process of being repointed and resharpened, on the other hand, are more difficult to distinguish because the objective pieces are quite similar.

Obviously, flakes from the breakup of cores with bifacial platforms and relatively small edge angles will be more difficult to distinguish from flakes removed during the retouch of projectile point preforms.

The significance of this discussion is that the assignment of individual debitage artifacts to functional categories is inherently prone to more error than is the assignment of debitage to the descriptive categories based on dorsal surface cortex. Those functional categories recognized, herein, however, can be arranged hierarchically in order of the confidence placed in their recognition. Arranged in this order, they are core preparation flakes, biface tool manufacture flakes, and finally core reduction flakes.

Core reduction (CR) flakes are the most difficult to identify functionally because—as mentioned below in the Probable Purpose Model—CR flakes recovered from a site are discards. Also, a variety of core reduction flakes are commonly produced since parent artifact flake requirements are different for retouched slicing and scraping tools, for projectile points, and for unretouched tools, to name a few of the more common tool types. Cores are commonly prepared and reduced to produce the parent artifacts for these tools and it is not unusual for core reduction flakes at a site to reflect this variability. Further, to find out what types of flakes were considered desirable, the tools and preforms ideally should be examined and their parent artifact flake types determined if possible, prior to the flake analysis. Logistic considerations often make it impossible to analyze the tools first and then the debitage. Finally, in a site collection containing large numbers of tools which have been made on cortex flakes, the determination has to be made whether this use was fortuitous or whether some cortex flakes are, in fact, core reduction flakes.

CORTEX AND NON-PROXIMAL FLAKE FRAGMENTS

The presence of cortex is not evaluated for the nonproximal flake fragments. The focus of this debitage analysis is the significantly more informative diagnostically complete flakes, i.e., whole flakes and proximal
fragments. There are two difficulties with any analysis of non-proximal flake fragments. The first difficulty is the determination of how many previously complete flakes are represented by the non-proximal fragments recovered from a component. On the other hand, flakes will have only one platform and bulb of force. This is what allows proximal fragments to be usefully employed with the complete flakes in the evaluation of debitage characteristics.

The second difficulty with non-proximal flake fragments is encountered when the presence of cortex is determined on these artifacts. Solely the presence or absence of cortex can be observed. To attempt to identify different types of cortex flakes, or stages of reduction, with these fragments is highly subject to error because portions of the flakes are missing. This brings up the previous difficulty. If a primary cortex flake is broken into three pieces it would be counted as three primary cortex flakes if debitage reduction stages were identified for the non-proximal fragments. These problems are easily avoided by not doing a functional analysis based on non-proximal flake fragments.

THE PROBABLE PURPOSE MODEL OF LITHIC DEBITAGE PRODUCTION

The Probable Purpose Model of Lithic Debitage Production presents the theoretical assumptions and propositions inherent in this functional interpretation of flaked stone debitage (Spencer 1987a & c, 1986; Spencer, Hanes, Fowler, Jaynes 1987). This explanatory model is an attempt to establish a pragmatic framework for understanding general patterns of activities based on observable attributes.

TERMINOLOGY

Artifact: any object made, modified, or used by people. Includes debitage, preforms, and tools.

Parent Artifact: the artifact chosen for use as an unretouched tool or for manufacture into a retouched tool.

Flaking: in this model, this term means the purposeful removal of a flake from an objective piece. Flaking does not mean use-wear or accidental damage. Note: this term has a different meaning from the term retouch as used herein (see glossary).

Debitage: this term applies to that class of flaked stone artifacts which is removed from an objective piece as a result of flaking, tool use, or edge damage. Debitage, along with tools and preforms, constitutes the totality of the class of flaked stone artifacts.

Reduction Sequence: this phrase is a theoretical construct and means a manufacturing continuum between raw material and finished tool. A reduction sequence may have branches as when a particular core is
reduced to produce the parent artifacts for projectile points, unifacially retouched scraping tools, and unretouched tools. Each tool has its own reduction sequence; however, the phrase is more useful and practical when it applies to a subclass of tools such as all unifacially retouched scraping tools from a particular component in a site made of a particular raw material.

**Flake:** a member of the debitage artifact subclass produced by the introduction of force into a core or other objective piece close to an edge which is less than 90 degrees, and usually over a guiding ridge.

**Flake tools:** herein, this term means those tools whose parent artifacts were flakes.

**Core tools:** herein, this term means those tools whose parent artifacts were cores or cobbles or nodules of raw material.

**Preparation:** herein, a term synonymous with manufacture and maintenance. Preparation is used most commonly with reference to those flakes removed in the manufacture and maintenance of cores. Core preparation flakes are terminologically distinguished from other tool manufacture and maintenance flakes because of the unique position of cores in the flake tool reduction sequence.

**GENERAL PROPOSITIONS**

1. Effectively, all prehistoric flaking was done with a desired end product in mind.

2. The end result of all flaking is the intended production or rejuvenation of a functional tool.

3. The subclass of all functional tools is made up of (a) unretouched tools, (b) unifacially retouched tools, (c) bifacially retouched tools, and (d) cores.

4. A core is a unique tool in that it is the initial tool in a flake tool reduction sequence. The purpose of a core is to produce flakes suitable to be the parent artifacts for one of the four kinds of tools defined above. Cores may be designed to produce flakes suitable for manufacture or preparation into other cores.

5. Cores were prepared and reduced as much for the production of unifacially retouched and unretouched tools as they were for the production of bifacially retouched tools.

6. All flakes removed from cores for the purpose of becoming tools may not become those tools or any tool or preform. When this is so these unused flakes are discards.

7. The parent artifacts of retouched and unretouched tools, while commonly core reduction flakes, are sometimes fortuitously chosen artifacts of other types, for instance BTM flakes or bifacial preform fragments may be
chosen as parent artifacts. These fortuitously chosen parent artifacts will belong to either the debitage, preform, or tool subclasses of the flaked stone artifact class.

8. A tool, preform, or piece of debitage may, at any time, leave one reduction sequence and branch into another, the end result of which is a different tool type or the discarded preform of another tool type (cf. Muto 1971b:110,117; and Spencer in Bard, Busby, & Kobori 1979:42).

9. Debitage resulting from tool use and unifacially retouched tool manufacture, while theoretically describable, is not practically identifiable at this time. While flakes of both of these types have been described in the literature, they are not consistently identifiable in most of their morphological variations.

The Purposes of Flaking. All flaking debitage is the result of one of three activities: core preparation, core reduction, or tool manufacture and maintenance.

Core Preparation. Core preparation is the process by which the specific morphological features of a core are produced, if necessary, and maintained during the use life of the core. At a minimum these features include a relatively flat platform; outerface containing guiding ridges; an outerface platform inside angle of less than 90 degrees; a slightly to markedly convex, or outward curving, outerface platform edge; and a minimum size. These features are designed to produce flakes of suitable size and shape to easily function as the parent artifacts for given tools. Those core preparation flakes (CP) which produce a given platform and outerface (if necessary) will usually be larger than the core reduction flakes subsequently removed from that platform along that outerface.

This debitage will be activity location specific at a site, that is, these flakes will remain where produced unless fortuitously chosen as the parent artifact for a tool or incorporated into a refuse discard episode.

Tool Manufacture and Maintenance. Unifacially and bifacially retouched tool manufacture and maintenance is the process by which the specific morphological features of a given tool are produced and maintained during the use life of the tool. At a minimum these features include the retouch of one side of an edge for unifaces, and the retouch of both sides of the same portion of an edge for a biface. These manufacture and maintenance flakes will be significantly smaller than the parent artifact that they are removed from.

The location of this debitage is also usually activity location specific at a site unless fortuitously chosen as the parent artifact for a tool or incorporated into a refuse discard episode.

Core Reduction. Core reduction is the removal of flakes from cores that will be suitable for use or modification. The morphological features of
these flakes depend on the type of tool they will become. Given an equivalent finished tool size the parent artifact core reduction flake (CR) can be smallest for an unretouched tool; with retouched tools, the more thoroughly retouched a tool is the larger the parent artifact core reduction flake will need to be. Core reduction flakes recovered from a site will always be discards, or debitage in the classic—waste—sense of the word (unless lost or cached) because all non-discard CR flakes will have become retouched or unretouched tools or preforms.

Because of the activities mentioned above, the location of these flakes in a site is not necessarily activity location specific. The core reduction flakes recovered from a site will necessarily be those flakes which, for one reason or another, were not used as the parent artifacts for tools. These flakes may be transported from their original location and stored for subsequent use or preparation in the form of heat treatment. Artifacts may be misidentified as core reduction flakes when wear or retouch present on them is not recognized. The implications of these considerations for the locational significance of core reduction flakes are that any identifications of CR flakes at any location rely on the associations of other artifact types.

Given a single component, core reduction flakes present in the absence of core preparation flakes, flake fragments, and angular waste imply that the CR flakes have been transported. Core reduction flakes associated only with biface tool manufacture flakes and, possibly, biface preforms imply that the CR flakes have been transported and were used as parent artifacts for bifacial tool manufacture. Core reduction flakes associated with unifacially retouched and unretouched tools imply that the CR flakes have been transported and used as the parent artifacts for unifacially retouched and unretouched tools. Core reduction flakes associated only with core preparation flakes, flake fragments, angular waste, and, possibly, cores imply that CR flakes are in their place of origin and are discards. Core reduction flakes associated with no other debitage implies that the flakes have been transported and have been discarded, lost, or cached. These associations can occur in combination with each other. These implications are, of course, applicable only to an undisturbed site. Table 1.1, below, presents the above locational and functional information in table form.

Because core reduction flakes recovered from a site are commonly discards, a realistic description—including size—of usable CR flakes also relies on the analysis of associated artifacts. Unifacially retouched and unretouched tools have usually retained enough parent artifact morphology to identify the CR flakes they were made on, if such was the case. The same can be said for some initial phase biface preforms. The flake scars on cores will also present some useful data in this regard, always remembering that most flake scars on cores have been truncated by other and subsequent removals.
Debitage Frequency Implications of the Model. It is assumed that core preparation, core reduction, and bifacial tool manufacture and maintenance each leaves behind different amounts of debitage and that, the more complex in terms of flaking a tool is, the more debitage it will leave behind. Bifacially retouched tools will commonly leave behind more debitage than will unifacially retouched tools (see biface bias discussion herein). Unretouched artifacts, on the other hand, while they are the end result of a particular reduction sequence, do not leave behind debitage other than that produced during tool use.

Because different activities produce different relative amounts of debitage merely comparing the frequencies of the debitage resulting from different activities is a problematic procedure for determining the relative importance of those activities. The debitage resulting from different activities needs to be weighted differently to obtain useful information about the importance of various activities based on debitage frequencies.

Debitage Size Implications of the Model. Debitage recovered from a site resulting from core preparation and bifacial tool manufacture is probably representative of the size of the flakes produced except for the absence of those flakes fortuitously chosen as the parent artifacts for tools. This is not the case with debitage resulting from core reduction activities. Because the CR flakes remaining in a cultural manifestation are discards it is probable that the size of these flakes is skewed away from the sizes deemed most useful by the people who removed the flakes.

Because the retouch process reduces the size of parent artifacts, flakes somewhat larger than those necessary for the finished retouched tool are usable. The lower end of the usable size continuum for a given tool class is more critical. While it is probable that flakes from the same core served as the parent artifacts for different tool classes, it is assumed that it will be the lower end of the size continuum that will be represented in the discard CR flakes from any sample. This may be tested by measurement of the size of the tools which may reasonably be expected to have been derived from the reduction sequence (s) in question and comparing them with CR flakes from a site.
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*all CR flakes are discards unless lost or cached *B. PREF. - biface preform, CR-core reduction or core reduction flake, CP-core preparation flake, FF-flake fragment, AW-angular waste, BTM biface tool manufacture flake, P.A.-parent artifact, UR-unifacially retouched and unretouched tools, B.- bifacially retouched artifact.
THE LITHIC TOOL AND PREFORM ARTIFACTS

Italicized words in the following text will be found in the glossary.

Tools and preforms are separated into four groups based on retouch characteristics or the absence thereof: (1) cores and core preforms, (2) unretouched tools, (3) unifacially retouched tool/preform artifacts, and (4) bifacially retouched tool/preform artifacts. The core and core preform group is self-explanatory. Unretouched tools are generally analogous to utilized flakes and are separated into scraping and slicing tools. Unifacially retouched tools and preforms are also divided into scraping and slicing tools and their preforms. Bifacially retouched tools and preforms are divided into flake bifaces and complete bifaces. The flake biface artifact class is further separated into slicing tools and biface preforms; the complete biface class is subdivided into generalized bifaces, slicing tools, preforms, projective points, and miscellaneous bifaces, such as, drills, choppers, etcetera.

The reader is directed to the portion of this section which discusses use-wear. In this discussion use-wear is differentiated from accidental edge damage and purposeful retouch as is necessary in any conscientious discussion of use-wear. Specific identifying attributes of use-wear used are discussed as well.

Finally, the reader should be aware that, herein, it is the working edges which are the unit of study and often there are more than one working edge per artifact. This means that the counts for working edges will be greater than the total of numbered and catalogued tool and preform artifacts.

Attribute Discussion. In the discussion to follow all attributes which are not self-explanatory will be described. Sometimes the procedures for identifying the same attribute are modified slightly for a different artifact class. When this is so only the modification will be described with the relevant qualification.

CORE ANALYSIS PROCEDURES

Definition. A core is a tool used to produce flakes suitable for manufacture into tools or suitable for use as a tool without further modification. The production of these flakes is a core's task, or use.

Description. Cores contain at least one relatively flat platform surface and at least one slightly to markedly convex outerface which intersects the platform and contains at least two flake scars. A variably irregular platform/outerface edge which is convex and which overhangs the outer face is also common. Cores are commonly angular in appearance, and are
also commonly made on nodules and, when this is so, often retain nodular cortex surface. Note: cores may be made on any parent artifact available as long as it is large enough to produce flakes of a desired size.

The Attributes

Core Size

In this analysis core height is equivalent to the length measurement on other artifact types. Height is a measure of the longest distance of the outer face surface perpendicular to the platform/outer face edge. Core height will translate into flake length. Core width is the greatest straight line distance roughly parallel to the platform/outer face edge. Thickness is the greatest distance across the platform perpendicular to the length and width measurements. If more than one platform is present on a core the largest or most heavily used outerface will determine which platform/outer face edge these measurements are related to for the specimen measurements.

Number of Platforms

Self-explanatory.

Platform Surface

Platform surfaces were identified as cortex, multifaceted, or having simple interior surfaces.

Platform Bifacial or Unifacial

Also self-explanatory. A platform is bifacial when it has served both as a platform and an outer face. For a platform to be identified as bifacial, flakes need to have been removed from both sides of the same edge, both surfaces intersecting to form a bifacial platform are also outerfaces.

Platform Outer Face Angle

The angle measured is an inside angle and the measurement is taken from the 1/3 of the relevant surface closest to the edge being measured. Marked concavities resulting from pronounced bulbs of force are dealt with by extrapolating a straight line from the point of contact to the distal extremity of the concavity.

Number of Flake Scars

These are the scars other than edge preparation. Even a small percentage of a flake scar is counted. Only scars with approximately 1/2 remaining are sized.

UNRETOUCHED TOOL ANALYSIS PROCEDURES

Definition. These are tools with working edges which have been altered solely by use and have not received retouch prior to use. Signs of
this use must, of course, be visible. In this analysis all use wear was examined with the unaided eye or a Swift ten power hand-lens and was illuminated exclusively by an incandescent light source.

Description. Since any unretouched edge may be used as a working edge of this tool type the description to follow is based on the use-wear. Only in a general fashion does this description refer to the morphology of the parent artifact the use-wear is superimposed on.

In this analysis the minimum description of an unretouched working edge is an unbroken parent artifact size of at least 10.0 mm as determined by circles and the presence on an edge of at least five flake scars of 3.0 mm or less in size.

These flake scars must be patterned in one of two ways. Pattern #1 is at least five contiguous, relatively even-sized scars on only one side of an edge. This pattern is usually produced by a tool used with the scraping use-motion. Pattern #2 is at least five contiguous or noncontiguous scars—in a 20.0 mm length—on each side of the same portion of the edge, scars will be oblique and perpendicular to the edge, striations may or may not be present but, if present, will be oriented parallel to the edge. This pattern is usually produced by a tool used with the slicing use-motion. Snaps, or bending fractures, may be present on either type of edge. Note: the presence of contiguous bifacial scars which have been removed perpendicular to the edge will be identified as retouch regardless of scar size. Dorsal, ventral, and platform edges, as well as dorsal ridges and fracture faces, were examined for wear.

There is a real possibility of confusing pre-removal platform edge preparation with use-wear. This potential problem is precluded procedurally by eliminating from consideration as use-wear any alteration on the platform/dorsal edge of a flake. The platform/dorsal edge of a flake is the only edge on a piece of debitage which can contain pre-removal edge alteration. In unusual cases post-removal alteration will be identified on the platform/dorsal edge of a piece of debitage. When this is the case the diagnostic attributes which have led to the identification of alteration as use-wear produced after the removal of the flake will be specifically discussed.

This tight procedural description of use-wear is an attempt to standardize probable identification error and to make results, thus, consistent and testable. It is accepted that there will be some confusion between use-wear, edge damage, backing, and retouch.

Differentiation of Use-Wear from Edge-Damage

Edge alteration that is the same for all the same angled edges is herein procedurally described as edge-damage. The presence of metal contiguous to alteration is considered edge-damage that has been caused during screening or excavation. Alteration on the dorsal distal end of a
steeply cupped or curved flake is also procedurally defined as edge-damage.

**The Attributes**

**Complete or Fragmentary**

This is determined for each tool and may be unrelated to parent artifact completeness. Broken artifacts, such as a flake fragment, may have been chosen for use as a tool. For a used artifact to be incomplete a fracture face must interrupt a working edge.

**Size**

Size is determined for this tool artifact class by circle-sizing alone. This allows a ready comparison with the debitage sizes, unquestionably the most common source of parent artifacts for this tool type.

**Parent Artifact**

Only tools and their preforms have parent artifacts. In the case of an unretouched tool, the parent artifact is the artifact type the tool-user chose for the task at hand. When possible the parent artifact type of each tool and preform is identified.

**Working Edge Attributes**

The working edge on an unretouched tool is the portion of the parent artifact edge used—where the wear is observed. A number of the following attributes are characteristics of the working edge.

**Number of Working Edges**

Some tools contain more than one working edge. When this is the case each working edge is treated separately. There are a number of ways in which one working edge is separated from another. Working edges are considered separate when they are located on different parent artifact edges, when separated by obviously unworn areas, when at least one of two working edges is concave, when working edges join to form an unworn projection, or when use-wear patterns #1 and #2 are present discretely on the same edge.

**Location of Working Edges**

The location of each working edge is identified according to the morphology of the relevant parent artifact, whether it was a flake or a broken biface. When the parent artifact of a tool is a flake the working edge locations are keyed to flake morphology.

For this purpose every flake parent artifact examined was oriented identically, as though on a page with its platform toward the top and its
dorsal or ventral side toward the reader; this allows the use of the terms left
and right in the location descriptions. If the working edge in question is
bifacial the surface listed, i.e., dorsal or ventral, is the dominant surface in
terms of number of scars or, if there is no apparent dominance, the dorsal
side is listed.

In the case of a parent artifact which is not a flake appropriate
locaional information, such as it is, is given.

Shape of Working Edge

The shapes documented for working edges are straight, convex,
concave, notched, and irregular.

Length of Working Edge

Length is measured to the nearest mm from one end of the working
edge in question to the other regardless of shape. For circumferential
edges, length is measured as the two longest non-intersecting but
contiguous straight lines drawn overlaying the retouch.

Flake Scar Count (FSC)

This is a measurement of the number of use-wear scars per 20.0 mm
length. Where the working edge in question is less than 20.0 mm long, a
10.0 mm count is taken and doubled. Where the edge is longer than 20.0
mm the count is taken from the area of most pronounced use-wear. Within
a working edge, snaps are counted as flake scars. Steps are not counted
unless they do not overlie nibbles.

Both sides of the same portion of an edge containing bifacial edge
wear were counted and the sum of the two counts was divided by two.

This flake scar count technique is an average and comparability
between different working edges is variable. Working edges with
contiguous flake scars and those with non-contiguous flake scars will not be
directly comparable and neither will straight edges when compared with
markedly concave or convex edges. Edge shape and the contiguity of flake
scars are both documented in this analysis. Concave and convex edges will
have a greater number of flake scars per cm than will straight edges, other
things being equal.

Edge Angle

Edge angle is taken from the working edge (use-wear angle) and from
the parent artifact edge containing the working edge (parent artifact angle)
when possible. This measurement is taken with the use of what is here
called a Displaced 10 Degree Increment Card. A regular 3 x 5 index card is
used for this purpose. A baseline is inked along the bottom of the card.
This baseline is marked off with points every 1.0 cm. Starting at the right a
10 degree inside arc is drawn from the first point. A 20 degree arc is drawn
from the second point to the left of the first and so on until a 90 degree arc
is drawn. The points or intersections of each arc are thus located 1.0 cm
apart on the line. The angle to be measured is placed next to the most similar angle and the edge is listed as the number of degrees identifying that arc. This technique measures only to the nearest 10 degrees.

Working Edge Angle. This measurement is taken when possible of the use-wear present on a working edge. This usually means that the use-wear scars themselves form at least one surface of a measured angle and thus only the first mm or so of that edge is used. The measurement is centered in the area of most pronounced wear. In the case of pattern #2 wear, discontinuous bifacial flake scars, often the working edge angle is effectively the same as the parent artifact edge angle, even in the area of most wear. At times the use-wear will be so small as to be unmeasurable.

Parent Artifact Edge Angle. This angle is the parent artifact (unworn) angle that is overlain by the use-wear. It is taken for one third (1/3) the distance across the narrowest surface which forms the edge in question. In the case of the use of a dorsoventral flake edge this is one third the distance to the nearest dorsal ridge. This regularizes the incorporation of dorsal surface flake scar concavities into the edge angle measurement.

Note: all or most edges have edge angles that are variable to a greater or lesser degree. Angles may, thus, be considered averages. With highly variable edges a range of values is noted.

Function

Pattern #1 use-wear identifies the unretouched working edge as having been used for scraping.

Pattern #2 use-wear identifies the unretouched working edge as having been used for slicing.

Types of Use-Wear

Grinding or abrasion is the removal of surface material by microscopically fine scale chipping. The individuality of the scars thus produced is not visible through a 10X hand lens; the surface itself is left diffusely reflective (cf. Hayden 1979:xvii).

Nibbles are minute flake scars with feather terminations.

Polish is the slow removal of surface material on a submicroscopic scale. This polish leaves a shiny surface (Hayden 1979:xviii).

Snaps, or bending fractures, are semicircular, concave removals on an edge. This type of removal produces are flat surface perpendicular to the average plane of the two surfaces making up the a edge (cf. Lawrence 1979:115).
Steps are a kind of scar resembling a step or ledge at its distal end and are caused by the breaking of a flake prior to its termination (cf. Hayden 1979:xvii-xviii).

Striations are scratches on the surface of a tool caused by the interaction of a surface with an abrasive particle. The abrasive particle may be either fixed in place or freely moving in relation to the working edge. Striations are especially important for determining the function of lithic artifacts. One of the striation types characterized below is produced by retouch; as such, this particular type of striation is not use-wear. Retouch striations are included here with use-wear striations for comparative purposes only.

Striations were divided into five types.

Retouch Striations. These striations parallel the removal axis of a retouch scar and generally run down its center, beginning about a third of the way from the initiation point of the scar. Retouch striations occur infrequently and, when present, are limited to one per flake scar.

Slicing Striations. These striations are oriented parallel to a given working edge and are usually present close to the edge. On complete bifaces this often means that these striations are oriented at an angle to the long axis of the tool unless the tool is parallel sided.

Impact Striations. These striations are oriented parallel to the long axis of the tool. They are usually concentrated in the medial and distal sections of a projectile point blade and are more common along the medial ridge of blade than along an edge. Note that the orientation of these striations means that they are commonly oblique to the edge of a point blade unless the blade is parallel sided.

Hafting Striations. These striations are oriented perpendicular to the long axis of a tool. They are usually quite short, often less than 5.0 mm in length, arranged together in small groups of commonly three to five striations, and located at the top center of the tool stem, or hafting area, along the medial ridge of the tool. Often these striations are associated with small areas of matte texture on raised portions of the surface which may be caused by grinding or heavy overlapping striations or both. These striations are thought to be caused by movement of the tool within the haft.

Scraping Striations. These striations, as observed with a hand lens, are so rare as to be considered virtually non-existent. The common orientation of a scraping tool in use is such that any striations present would be located along the lower third of the retouch surface. Retouch striations are commonly confused with scraping striations. An easy way to differentiate the two is that use-wear is usually concentrated along raised portions of a working edge, whereas retouch striations are usually located at the center of the flake scar trough.
In this analysis care was taken to differentiate fissures and bedding planes from striations. Fissures are always multiple, curved, roughly parallel to each other, contained wholly within a flake scar, usually present along one side of a flake scar, and are always radial to the point of contact for the removal scar in question. Bedding planes in the material, on the other hand, are commonly present on both surfaces of a tool.

Except in the case of retouch striations, a minimum of three striations oriented parallel to each other were required for diagnostic purposes.

*This key functions within tool/preform reduction sequence(s) based on the use of flakes as parent artifacts. Discarded tools and preforms are occasionally selected as the parent artifacts for other retouched tool/preforms or unretouched tools.

**Figure 1.3. Descriptive Tool/Preform Key.
RETOUCHED TOOL AND PREFORM ARTIFACT

ANALYSIS PROCEDURES

Note: new attributes and changed attributes will be discussed here. Attributes identical to those described in the preceding section on Unretouched Artifacts will not be mentioned.

RETOUCH

Definition. Retouch is the purposeful removal of any flake (producing a flake scar) from the edge of any artifact to shape that edge or surface. Retouch includes core preparation, tool manufacture, and backing, but does not include use-wear or core reduction. There are only two possible types of retouch: unifacial and bifacial.

All of the artifacts and working edges discussed from here on in these procedures are retouched.

Description. In this analysis the minimum description of retouch is the presence of an edge of at least three (3) contiguous, even-sized flake scars in excess of 3.0 mm in length and width on one side of an edge, i.e., unifacial. Any examples of three contiguous 3.0 mm long flake scars perpendicular or oblique to and on each of both sides of the same portion of the edge, i.e., bifacial, are retouch regardless of size.

UNIFACES

Description. This class of artifacts is made up of those preform and tool edges containing retouch on only one surface of an edge.

The Attributes

Size, Length, Width, and Thickness

Size is measured by the use of circles so that these tools can be compared with the debitage. Additionally length, width, and thickness were measured to the nearest mm. If the parent artifact of the uniface is a flake, then length is measured from the point of contact through the ripple centers to the termination. Width is the maximum measurement perpendicular to length and thickness is the maximum measurement perpendicular to width and length between the dorsal and ventral surfaces. If the parent artifact is not a flake then appropriate length, width, and thickness measurements are taken.
Retouched or Working Edge Attributes

The same as unretouched tool working edge attributes with these distinctions: the retouched/working edges are retouched, or purposefully formed, and use-wear may overlay this retouch.

**Flake Scar Count**

On a retouched edge, the count is taken from the average size flake scars and not from the areas of heavy stepping within a millimeter of the edge.

**Retouched Edge Angle**

This measure is taken from one third (1/3) of the length of the average flake scar unless this distance would put the measurement outside of the main surface curvature.

FLAKE BIFACES

*Description.* This class of artifacts is made up of flakes solely with bifacial edge retouch only. Edge retouch, as the name implies is confined near the edge of the artifact and is not invasive.

**The Attributes**

The attributes of this class of artifacts are identical to those of unifaces except for flake scar count

**Flake Scar Count**

This measurement is taken from both sides of the same portion of the edge and divided by 2.

COMPLETE BIFACES

*Description.* Artifacts of this type have at least one bifacially retouched edge and the majority of at least one surface covered with invasive flake scars, exclusive of post-manufacturing fractures and heat spalled surface.

**The Attributes**

**Flake Scar Count**

In the case of a biface with two or more bifacially retouched worked edges which are not separate working edges, i.e., a projectile point blade, counts are taken from both sides of both edges, summed, and divided by four (4).

**Parent Artifact Surface**
If any pre-retouch parent artifact surface observed, it is noted and identified, if possible, for example, "Parent flake dorsal, ventral, or platform surface is present."

**Hafting**

A tool has been hafted if it has been attached to a handle or foreshaft. Several types of visible evidence are used as proof that a tool has been hafted. A tool is considered hafted when completed proximal notching or shouldering is observed; when a pattern of striations or small scars are noted oriented perpendicular to tool length removed from the medial ridge in the proximal area of the artifact; when polish or grinding in the form of a matte finish is noted on the raised portions of the proximal area, or when basal edge abrasion is noted.

Hafting is inferred when impact fracturing is noted on an artifact or when other evidence is observed of an artifact being a finished projectile point.

**Damage**

Four types of damage were documented.

**Heat Damage.** Traumatic heat alteration in the form of potlids or crazing was noted as heat damage.

**Manufacturing Damage.** Fractures which could be verifiably identified as being caused by manufacturing activities were noted as manufacturing fractures. These are fractures which originate inside a notch, are associated with an abrupt change in artifact width or thickness, or are initiated from a lateral margin of a biface and propagate at an angle to the long axis of the artifact (cf. Spencer 1976: 11-13).

**Impact Damage.** This fracture is caused by use of an artifact as a projectile point and is unique to that use. It is the impact fracture, a fracture that originates at the distal end of a point and propagates proximally down a surface (s) parallel to the long axis of the point. Occasionally, the forward momentum of projectile shaft will produce a similar fracture originating at the proximal end and propagating distally. When found on a stemmed point, this latter fracture will usually initiate at the intersection of the stem with the body of the point (cf. Spencer 1976: 11-13).

**Ambiguous Damage.** A final type of fracture is noted as ambiguous. The fracture herein identified as ambiguous is probably often identical to Crabtree's "endshock" (1972: 60). Crabtree states that this is a transverse fracture caused by shock which exceeds the elastic limit of the material in question. Descriptively, this is a flat fracture, sometimes accompanied by a weak hinge, which commonly contains no flake features or, at most diffuse ripples oriented to a surface and not an edge or an end. This type of fracture occurs during manufacture and also during use of projectile points and thus is ambiguous.
Rejuvenation

Rejuvenation is a type of retouch carried out on a dysfunctional working edge for the purpose of making it functional again. Resharpening a worn slicing tool working edge is a form of rejuvenation, as is the repointed of the distal end of a projectile point. Herein, rejuvenation retouch was identified by the co-occurrence of two or more of the following characteristics: asymmetry in an tool, the unifacial beveling of a bifacial edge, observable remnants of damage, significant truncation of flake scars.

Neck Width and Length

Neck width is determined to be the shortest distance within the distal portion of any haft-notching whether it be basal-notching, corner-notching, or side-notching. For those projectile points with shoulders, neck width is the width of the stem at the base of the shoulders.

Neck length is the measurement from the base of the point to the location of the neck width measurement.

Barb Length

Barb length is measured as the distance each barb extends below a straight line drawn between the top of the two notches. One of the notches forms an edge of the barb in question.

Heated Surface (textural difference)

Heated surface is documented as present when a textural difference is observable on the artifact that can be attributed to heat alteration, i.e., the two different textures must both be present on the artifact.

BACKING RETOUCH

Definition. Backing is the purposeful alteration of an edge for the purpose of dulling that edge, either to facilitate hafting or handling during use. Excluded from consideration here is backing (edge grinding or dulling) that is present on the stem or proximal portions of any obviously hafted tool, such as, a projectile point. The reason this latter type of alteration is excluded from consideration is that it is already recognized and incorporated into the type description—either implicitly or explicitly—of these tools. At present, discussing it here would be needlessly confusing.

Description. Note: backing is inherently difficult to identify and this identification once made is more subjective than most functional characterizations in this analysis. Since backing is intentional dulling—that is its use—there is no necessary morphological patterning to the alteration that results, it may be bifacial or unifacial.

There must be another altered edge on the tool that is identifiable as having been used for slicing, graving, perforating, scraping, any use other than backing. It is preferable that the other edge in question be a slicing or
a perforating edge since these uses, potentially, bring the hand into more precarious contact with sharp edges than do other uses that readily come to mind. The backing must effectively dull a platform corner or other projection opposite a working edge. The alteration identified as backing must be anomalous in some way, interfering with the straightforward identification of the alteration in question as having been used for a purpose other than backing.

PROBLEMS

Problems will always be encountered of one type or another. These problems will always be discussed. I have excerpted the section on problems that I encountered in one lithic analysis.

Small Population Size

The very small population sizes (they average less than five artifacts per discrete analytical group) of the various debitage types from each level and of each material has constrained the nature of the comparative statements made, herein. Generally, only fairly gross comparisons can be made.

Frequency Skewing

During the analysis of the debitage sample, additional tool/preform artifacts were identified. These new tool/preform artifacts number 22. A certain amount of this "discovery" is to be expected. The number of tools observed in this case, though, calls all tool frequencies into question from outside of the sample proveniences. The unretouched tool category was increased by 100%. Any comparison that did not take into account the increased tools from the sample proveniences would be seriously skewed, particularly the unretouched and unifacially retouched tools. For this reason in the body of this report frequency and provenience information will be compared solely for the artifacts from the sample proveniences.

All of the artifacts, recovered during field work will be used to generate morphological information. This latter data may be skewed as well, but it is assumed herein that this skewing will be within an acceptable range of error.

Level A

I have been informed by the Principle Investigator of the site that Level A and the surface of the site have been strongly affected by wave action and by artifact collecting. Bear this in mind when seeing apparently significant distributions of artifacts within this level.
GLOSSARY

ALTERATION
--Any cultural or noncultural change in the pristine nature of a lithic edge. A generic term that includes retouch, use-wear, and edge damage.
--See: Edge Damage, Retouch, and Use-Wear.

ANGULAR WASTE
--An artifact class which is considered to be an accidental by-product of flake removals. Thought to be platform shatter. Size of angular waste probably related to flake size and removal trauma; angular waste of a size to be retained in 1/8 inch screen is probably from core preparation and reduction activities or relatively massive tool manufacture.
--Similar to chunk and shatter.

ARTIFACT
--Any object used, moved, or modified by man. The generic class to which all cultural flaked stone belongs. Debitage; preforms; and tools describe the totality of flaked stone artifacts from any component or site. Note: the terms heat spall, angular waste, and flake herein are defined morphologically and that they are artifacts is accepted. While this will ordinarily be the case—in particular when these items are associated with other artifacts—it is not always the case. Heat spalls may be produced in a wild fire, angular waste in a streambed, and flakes in an alluvial fan. In problematic situations, context and associations need to be considered because the mechanics of the fracture process are invariant. What makes cultural flakes so distinctive is that people control the introduction of force and the shape of the objective piece generally to enhance flakability. The fracture mechanics are the same as those produced naturally (see flake discussion in LSA lithic analysis procedures).
ATTRITION-WEAR
--Wear in the form of flake scars, grinding or polishing, as opposed to the deposit of silica sheen or other residue.

BACKING
--Purposeful dulling of an edge to facilitate holding a tool during use. Often this type of edge alteration is more visible than the working edge in question. This is especially true for lightly used slicing tool edges. Backing is a form of retouch.

BIFACE
--A tool or preform with an edge formed by retouch along both sides of the same portion of an edge. These scars may be confined to the edge or may travel completely across the surface of an artifact.
--See: Uniface and Retouch. Also see Tixier (1974:4) and Crabtree (1972:38).

BIFACE BIAS
--The tendency to identify bifacial tool manufacture/rejuvenation as the most important reduction activity in a site component when solely using frequency comparisons of debitage and preform/tool types for interpretive purposes.

BIFACIAL PLATFORM CORES
--A core with flakes removed from both sides of the same portion of the edge. On this type of a core, the platform alternates as the outerface and vice-versa.

COMPLETE BIFACE
--In this analysis, any artifact having at least one bifacially retouched edge and the majority of at least one surface covered with invasive flake scars, the latter exclusive of post-manufacturing fractures and heat spalled surface.

CONTINUOUS LIP
--A projecting platform/ventral edge which extends uninterrupted from one platform/dorsouteral corner to the other and overhangs the ventral side. Similar to the term, lip, as defined in Crabtree (1972:74). Differs from
Crabtree's term in that a continuous lip is not interrupted by a node or point of contact.

--See: Node. Also see Crabtree's term, point of contact (1972:84).

CONTRARY FLAKE SCARS

--Scars on the dorsal surface of a flake that come from a direction significantly different from the direction of the force that produced the flake in question (Spencer 1981 and 1986).

CORE

--A tool used to produce flakes suitable for manufacture into other tools or for use as is; the production of these flakes is a core's use.

--See: Objective Piece. Similar to Crabtree's term, nucleus (1972:79). Also see Bradley's (1975:6) term, primary core.

CORE BREAKUP

--A general term encompassing both core preparation and core reduction.

CORE PLATFORM

--The flattened surface of a core into which removal force is introduced. May be a natural cortex surface or a prepared interior surface made up of one or more flake scars.

--See: Flake and Core. See also Tixier's plan de frappe, or striking platform.

CORE PREPARATION Flake

--A type of flake removed from a nodule or parent artifact during the process of forming a functional core. These flakes are removed during the formation of the platform, the outer face, the appropriate platform/outer face angle, the removal of cortex or undesirable material, or the preparation of ridges to guide the removal of core reduction flakes. Since a core is herein considered to be a tool a core preparation flake is a tool manufacture flake of a very specific type. Similar to primary flake and secondary flake.

--See: Core Reduction Flake and Tool Manufacture Flake.
CORE REDUCTION

--The process by which potential tool production flakes, or parent artifacts, are removed from a core, the task of a core. Core reduction is not a type of retouch as the latter term is used here.

--See: Core Reduction Flake, Core, and Parent Artifact.

CORE REDUCTION FLAKE

--A type of flake removed from a core for the purpose of becoming a tool. Strictly defined, the identification of the salient attributes on this class of artifacts requires reference to tools and tool manufacturing processes in the relevant site component. The term core reduction flake is not the same as interior, or tertiary, flake.

--See: Flake, Parent Artifact, and Core Reduction. Similar to: interior, or tertiary flake. Also see Bradley's (1975:6) term, primary flake blank.

CORE TOOL

--Herein, this term means those tools whose parent artifacts were cores, cobbles, nodules, or other massive pieces of raw material that were not flakes.

CORTEX

--The weathered exterior of a nodule. Cortex will be found only on the dorsal and platform surfaces of a flake.

--See: Nodule and Flake.

CURATION

--The removal of an artifact from its the place of its manufacture or use. Commonly only fragments of curated tools are recovered from areas where they are used.

DEBITAGE

--A lithic artifact class: It includes the following artifact types: flakes and flake fragments, angular waste, and heat spalls. May be applied to wood or bone chips or shavings, as well. Debitage artifacts along with tool and preform artifacts form the totality of the class, flaked stone artifacts.
DIAGNOSTICALLY COMPLETE FLAKES
--In this analysis, whole flakes and the proximal fragments flakes.

DISTAL
--see: Flake Areas

DORSAL RIDGE
--A surface attribute formed by the intersection of a negative scar with another scar or cortex on the dorsal surface of a flake.
--See: Outerface. Similar to arris, arete, nervure (Tixier 1974:4,5,22) interflake crest, and crest (Crabtree 1972:56).

DORSAL SURFACE
--This term refers to a flake surface which was originally the outer face of a core or an outside of the objective piece. This surface contains negative flake scars, ridges, and/or cortex.
--See: Outerface.

EDGE
--A morphological term used to describe the intersection of any two surfaces. This is the working portion of flaked stone tools. Examples are: the dorso/ventral edge, the platform/dorsal edge, the platform/ventral edge, the ridge formed by the intersection of any two flake scars, and the intersection of a fracture face and any other surface.
--See: Surface.

EDGE DAMAGE
--The accidental alteration of an artifact edge; alteration not due to retouch or use of an artifact; non-artifactual alteration. Commonly defined differently for different sites. Must be differentiated whenever use-wear is defined. Most often confused with use-wear caused by the slicing use motion.
--See: Alteration, Use-Wear, Retouch.

ERAILLURE FLAKE SCAR
--A negative representation of a secondary fracture produced at the same time as the main fracture on the ventral, or positive, surface of a flake. An
eraillure scar is a small flake scar which is sometimes present on the proximal half of the positive bulb of force and which propagates laterally from one of the pronounced fissures associated with the point of contact. Not always present. Most pronounced with hard hammer percussion and may be directly related to removal trauma.

--See Crabtree (1972:60) and Spencer (1981:30).

FEATHER TERMINATION
--see: Termination

FINE FEATHERED EDGE
--A dorso/ventral flake edge with an angle of less than 20 degrees.

FINISHED TOOL
--This term is included for clarification purposes only. Synonymous with "tool" since, herein, every tool is by definition finished. What have been termed "unfinished tools" are preforms.

FISSURES
--Fine grooves or lines radiating out from the point of contact along the surface of a fracture face. This feature is associated primarily with the point of contact and one lateral edge: ventrally the edge furthest from the flake's dominant dorsal guiding ridge. More pronounced with hard hammer percussion and may be directly related to removal trauma.


FLAKE
--An artifact class produced by the introduction of force into a core or other objective piece close to an edge which is less than 90 degrees, and usually over a guiding ridge.

Specific Attributes

Platform surface: lip and/or node may be present.

Ventral surface: point of contact, bulb of force, waves, ripples, and fissures, all represented positively. Eraillure scar may be present.
Dorsal surface: point of contact, bulb of force, waves, ripples, and fissures, all represented negatively, to varying degrees, in whatever flake scars are present. Cortex may be present. Eraillure scars will not be present.

Shape: in transverse, side-to-side cross-section the ventral side is smoothly convex and any dorsal flake scars are smoothly concave and bounded by ridges; in longitudinal cross-section the ventral surface is concave, commonly with wave-like undulations, and the dorsal surface is convex.

--See the term flake in Crabtree (1972:64) and Spencer (1981:27-30).

FLAKE AREAS

--Descriptive terms for the anatomy of a flake, inclusive of surfaces and edges. Proximal: portion of a flake containing the platform and bulb of force. Distal: portion of the flake containing the termination. Medial: center of the flake. Lateral: portion containing two or more of the above portions and one dorsoventral margin. Left or Right: pertaining to dorsal, ventral, or platform lateral edges. Note: the dorsal-left edge is the ventral right edge.

FLAKE BIFACE

--Artifact containing bifacial edge retouch only.

FLAKE ORIENTATION

--The way in which a flake is held during analysis which allows the use of the terms left or right. In this analysis all flakes are oriented with their platforms towards the top of the page, and--unless otherwise indicated--their dorsal sides in plan view.

FLAKE PLANE

--A generalized, variably curved, end-to-end, two dimensional surface passing between the left and right dorsoventral edges. The platform of a flake may be more to one side or the other of this plane, i.e., to the dorsal or ventral side. Whether this is so is related to guiding ridge prominence and the curvature of the platform outer face edge. For example, biface tool manufacture flake platforms are commonly to the ventral side of this plane, whereas the platforms of core preparation and reduction flakes are commonly to the dorsal side of this plane.
FLAKE PLATFORM SURFACE
--Present at the proximal end of the complete flake, this flake surface is a remnant of the objective piece platform and is contained between the platform/outer face edge and the point of contact.

FLAKE SCAR
--See: Negative Flake Scar

FLAKE TOOL
--Any tool which has a flake for a parent artifact. A term sometimes used loosely to designate a tool made on a flake which retains most of the morphology of the parent artifact.

FRACTURE FACE
--An artifact surface, a flat-faced fracture on a flake or other artifact which is generally perpendicular to the length and/or width of the artifact. This surface forms an edge with other surfaces it contacts and this edge is often used as a working edge of a tool.
--See Crabtree's terms, amputated (1972:33,61) and end shock (1972:60,61).

GENERALIZED BIFACE
--Any bifacially retouched tool/preform artifact which cannot be functionally identified; a typological class of artifacts. Commonly fragmentary bifaces, including very small fragments, are classed as generalized bifaces because of the lack of diagnostic features. Note: no attributes identify an artifact as a member of this typological class other than the presence of bifacial retouch; it is the absence or paucity of functional or stylistic attributes which identify membership.

GRINDING
--See Use-Wear.

GUIDING RIDGE
--Any ridge on the dorsal side of a flake prominent enough to have had a dramatic influence on flake shape.
HEAT SPALL

--An artifact or object produced by the traumatic introduction of heat into a piece of lithic material. Whether heat spalls are culturally or nonculturally produced will usually be determined by context and attributes.

--See pot-lid in Oakley (1957:15-17) and potlid in Crabtree (1972:84).

HINGE TERMINATION

--See: Termination.

INTERFLAKE CREST

--A ridge formed by the intersection of two negative flake scars. This phrase is commonly used with reference to the retouched surfaces of an objective piece.

--See: Ridge.

INTERIOR FLAKES

--This is a descriptive flake category referring to those flakes removed from a core or other objective piece containing little or no cortex. In this report interior flakes have dorsal surfaces containing 100% interior surface or less than 25% cortex located distally contiguous to the termination. Some cores retain a small patch of cortex at their bases and this cortex is occasionally captured by flakes removed late in the reduction sequence of the core. The location and the amount of cortex permitted in this definition is to allow the inclusion of such flakes in the interior flake category. In one analysis of the author's only 16 (2.9%) of 549 interior flakes checked contained cortex of this type.

INTERIOR SURFACE

--Any non-cortex surface.

LATERAL

--See: Flake Areas.
LIMINAL ARTIFACT

--A tool which has been finished but not used and is thus identical to some unfinished and otherwise undamaged preforms. A boundary state of a tool artifact during its manufacture and use life.

LIP

--The projecting portions of the platform/ventral edge. How pronounced this attribute is varies, although most flakes exhibit it to some degree in the platform/dorso/ventral corners.

--See: Continuous Lip.

LITHIC REDUCTION SEQUENCE

--This phrase is a theoretical construct and means the manufacturing continuum between raw material and finished tool. A reduction sequence may have branches as when a core is reduced to produce the parent artifacts for projectile points, unifacially retouched scraping tools, and unretouched tools. Each individual tool has its own reduction sequence; however, the phrase is more useful and practical when it applies to a whole subclass of tools such as unifacially retouched scraping tools made of basalt from a particular component in a site. Any component containing more than one tool type contains more than one reduction sequence.

MANUFACTURING PROCESS

--The operation (s) by which a retouched tool is produced extending from the parent artifact to the tool and including the relevant morphological changes that occur. The process may incorporate identifiable stages, as in the production of a projectile point from a core reduction flake, or it may be a single stage, as in the retouch of a simple uniface.

MEDIAL

--see: Flake Areas

NEGATIVE FLAKE SCAR

--The negative representation (mirror image) produced on the surface of any objective piece by the removal of a flake.

NIBBLES

--See: Use-Wear
NODE

--An attribute of the platform surface of a flake, a node is a small hemispherical projection from the center of the platform where it intersects the ventral surface at the point of contact. Not always present. More pronounced with percussive flake removals.

--See Spencer (1981:31). See the term, point of impact, in Oakley (1957:15) and the term, point of contact, in Crabtree (1972:84).

NODULE

--An unmodified piece of lithic raw material, usually with a cortex exterior. These specimens are commonly smaller than a VW. An assayed and discarded nodule would be the preform of a core and no longer a nodule by this definition.

OBJECTIVE PIECE

--Any artifact from which flakes are purposely removed (retouch) whether that artifact is a core, another tool, or a manufacturing stage of another tool.

--See Crabtree's use of this term (1972:48).

OBJECTIVE PIECE PLATFORM

--Any surface of an objective piece into which force is introduced to remove a flake.

ORIGINAL FLAKE SURFACE

--Any remnant parent artifact surface on a tool or preform if the parent artifact was a flake.

OUTERFACE

--The surface intersecting the platform on a core or other objective piece containing the guiding ridges beneath and along which force is introduced and propagated.

--See: Core, Flake, Dorsal Ridge. Also see Sollberger (1980:33) and Spencer (1981:29).
OVERSHOT Flake

--Any flake which travels completely across the surface of an objective piece and removes a relatively large portion of an opposite edge. This term is usually used with reference to biface tool manufacture flakes. Commonly the platform is missing and the resultant termination is sometimes mistaken for the lateral fragment of a biface.

--See: Tixier's term, outrepassé, in Crabtree (1972: 80). Also see Undershot Flake.

PARENT Artifact TYPE

--The artifact class originally containing any tool or preform prior to use in the case of unretouched tools--or retouch. For instance, if a core reduction flake is picked up and used to fillet a fish, it becomes an unretouched tool and the core reduction flake is that tool's parent artifact. Similarly, if a core preparation flake is retouched into a knife, the core preparation flake is that knife's parent artifact. Parent artifacts are identifiable either with reference to the artifact's morphology or by remnant parent artifact surface retained on a tool or preform. May not be identifiable.

PLATFORM/DORSAL SIDE ANGLE

--The angle formed by the intersection of the platform and the proximal portion of the dorsal side of a flake. This is the angle of the platform and the outer face of the core or other objective piece from which the flake was removed from. On a tool manufacture or resharpening flake this is the original edge angle of the preform or tool.


POINT OF CONTACT

--A term from Crabtree (1972:84). An attribute of a man-made flake, the point of contact is a small, classic Hertzian cone produced at the point of introduced force at the top of a fracture, sometimes associated with a hemisphencral ventral extension of the platform of a flake (a node). Contains its own ripples and fissures. Most pronounced with hard hammer percussion and least with pressure or soft hammer percussion. It may be argued though, that, during soft hammer percussion, the totality of any platform surface with a continuous lip constitutes, literally, a point of contact. Herein, the term is used to refer to the presence of a small hertzian cone.

--Similar to Crabtree's contact area (1972: 44) and to Oakley's point of impact (1957:15).
POLISH
--see: Use-Wear

POT LID
--see: Heat Spall

PREFORM
--Any unfinished, retouched artifact. This unfinished state must be demonstrable and thus must have diagnostic attributes. The continuum between parent artifact and tool may be broken up into several identifiable and variably arbitrary preform stages or may not, as with unifaces. A preform may be used at any point in the manufacturing process for a task other than that for which it was designed.

All retouched tools have at one time been preforms. Preforms themselves, however, only exist within the archaeological record when abandoned, used as parent artifacts for other tools, cached, or lost. Preform attributes will vary according to the parent artifact type, the tool type, and retouch technology. This definition incorporates the "blank" stage of Muto (1971:43), Crabtree (1972:43), and Bradley (1975: 5), and thus differs from the definitions of preforms by these authors.

PREFORMING
--The process of manufacturing a retouched tool.

PREPARATION
--A term synonymous with manufacture and maintenance. Preparation is used most commonly with reference to those flakes removed in the manufacture and maintenance of cores. Core preparation flakes are terminologically distinguished from other tool manufacture and maintenance flakes because of the unique position cores hold in the flake tool reduction sequence.

PRISTINE The condition of any flake edge or surface immediately after removal from an objective piece and prior to any alteration.

PROXIMAL RIDGE PREPARATION
--The modification of a guiding ridge contiguous to the platform of an objective piece.
PROXIMAL
--See: Flake Areas.

REJUVENATION
--The process of regenerating a dysfunctional working edge. May be one flake removal, as in some core platform rejuvenations, or many removals, as in the rejuvenation of a damaged projectile point.

RETOUCH
--The removal of any flake from, or the production of a flake scar on, the edge of any artifact for the purpose of shaping that edge or a contiguous surface. Includes core preparation and tool manufacture, but does not include use-wear or core reduction. There are only two possible types of retouch: unifacial and bifacial. Note: this definition differs from Crabtree (1972:89).

RETOUCED ARTIFACT
--An artifact which has been formed through retouch. Includes cores, and unifacially and bifacially retouched preforms and tools.

REVERSE HINGE
--A fracture type separate from that which produced the flake. Occurs during the removal of a flake from an objective piece. The fracture is initiated on the dorsal or ventral side and terminates on the opposite side of the flake in question. A cross section of this fracture commonly has an S shape. Appears to be associated with some sort of bending or flexing tension during the removal. Common on blade-like flake fragments produced during tool manufacture. Medial fragments of this type of flake often have positive-reverse hinges on either end. A reverse hinge may have a hinge termination, or a step fracture at its distal end.

RIDGE
--The intersection of any flake scar with any other surface whether ventral or dorsal surface, cortex, platform, negative flake scar, or etc. May refer to the
interflake crests on the surfaces of a retouched artifact. Ridges act as a
guide to the propagation of a fracture beneath them. May also refer to
natural ridges on the outside of a nodule.


RIPPLES

--Narrow, closely spaced, concentric rings fanning out from the point of
contact and superimposed over the bulb of force and over the waves and
fissures on a flake. More pronounced with hard hammer percussion.

--See: waves. See Crabtree's compression rings and ripples (1972:52,89)
and see Spencer (1981:31).

SCRAPING

--A tool use motion common to both unretouched and retouched tools. Use
of working edge with a movement perpendicular to the long axis of that
edge. Usually understood as unidirectional. Typical wear produced is
contiguous, unifacial nibbles with striations perpendicular to the working
edge. Stepping is variable. On a unretouched working edge this use-
motion results in wear which may be mistaken for fine unifacial retouch.

SIMPLE INTERIOR PLATFORM

--A platform of a flake or core that contains a single facet, flake scar, or
portion of a flake scar--is not multifacetted--and no cortex.

--See: Interior Surface.

SLICING

--A tool use motion common to both unretouched and retouched working
edges. Use of a working edge with a movement parallel to the long axis of
that edge. May be unidirectional or bi-directional. Typical wear produced is
noncontiguous, bifacial nibbles, snaps, and striations oriented parallel to the
working edge. Steps are often present but they are much less common
than with the scraping use-motion. Nibbles and steps are sometimes
oriented oblique to the edge. Stepping is variable. On used edges this type
of wear might be confused with edge damage.

SNAPS

--See: Use-Wear.
SPRING CHINOOK

--A subspecies of the chinook salmon (Oncorhynchus tshawytscha) which enters fresh water in the spring, holds in those waters until late summer or early autumn, and spawns in August and September in Northwest Coast rivers. Like all Pacific salmon, the spring chinook returns to its natal stream and dies after spawning. The spring chinook is commonly larger and has a higher fat content than the autumn running chinook.

STEP See: Use-Wear; Step Fracture.

STEP FRACTURE

--A type of fracture separate from that which produced the flake; the truncation of a flake prior to the "normal" termination of the removal. Common on the working edge of a scraping tool. This fracture is not a flake termination. On the flake itself a step fracture looks like an fracture face, or amputation.

--See: Crabtree (1972:93).

STRIATIONS

--See: Use-Wear.

SURFACE

--A morphological term used to describe a planar area bounded by edges on the outside of an artifact. Examples are: on a core, the platform or the outer face; on a flake, the dorsal or ventral sides, the platform surface, negative flake scars; on a retouched tool, the retouched surface, parent artifact surface. Some descriptive surfaces are made up of smaller surfaces. For instance the outer face of a core, the dorsal side of a flake, and a retouched surface are each made up--commonly--of intersecting negative flake scars.

--See: Edge.

TASK

--See: Tool Task.

TERMINATION

--A characterization of the way in which propagated force ultimately separates a flake from its objective piece. A termination is part of the same
fracture that removes the flake—it is not a separate surface—it is the termination of that fracture.

--There is only one termination type, the hinge fracture. What is normally called a feather termination is really a minute hinge. It is important to distinguish pronounced hinges from minute hinges. This is the distinction that I am making here.

--Hinge Termination: the smooth movement of the distal end of the flake away from the center of the objective piece, and up 180 degrees. There may be several of these undulations diminishing in size.

--Feather Termination: a sharp, non-rounded termination with a minute hinge which is less than 1/5 of the flake's width.

--See Step Fracture.

TOOL

--Any artifact which has been used for a task. May be retouched or simply use-worn (an unretouched tool). Note: a preform is not a tool since it has not been used.


TOOL MANUFACTURE Flake

--A flake produced by retouch during the process of manufacturing a tool. There are two generic categories: biface and uniface tool manufacture flakes.

TOOL TASK

--The work done, or to be done, by a particular tool; the function of a tool. Identified by working edge use-wear or retouch morphology of the tool. Thus heavy unifacial use-wear with stepping on a working edge implies a scraping use-motion; this is the task of this tool's working edge as determined by use-wear on the tool. However, a classic Desert-Side-Notched projectile point is understood as an arrow point used for hunting game even if no use-wear is present; this is the task of this tool as determined by the formal morphology of the tool.

TOOL TYPE

--The tool artifact class to which a tool belongs. Determined by use-wear and retouch morphology. Use-wear, in the absence of retouch, identifies the tool type as unretouched tool. Completely retouched artifacts are often
identified by the shape imparted to the artifact by the retouch, examples of this are the projectile point, a drill, or a core.

--See: Tool Task.

TOOL USER

--The person who uses a tool.

TRANSPORT ARTIFACT

--The artifact class removed from a quarry, a workshop site, or any other production area by the people using that site. May be a nodule, a core, an initial or generalized preform, or a finished tool. May be any artifact class.

UNDERSHOT FLAKE

--Any flake which terminates less than two platform thicknesses below the platform. On these flakes the platform is commonly as large or larger than the dorsal side. When removed during the production of bifaces these artifacts are often mistaken for the lateral fragments of bifaces.

--See: Overshot Flake.

UNIFACE A tool with a working edge formed by retouch along only one side of an edge.

--See: Biface and Retouch. Also see Crabtree (1972: 97)

UNRETOUCHED TOOL A tool with a working edge which has been used without prior retouch. Similar to utilized flake, used flake, and used edge without the ambiguities inherent in such terms, i.e., untouched working edges are found on parent artifacts other than flakes and all tool edges, whether retouched or unretouched, are used.

USE

--See: Tool Task.

USE-MOTION

--Characteristic way in which a working edge is used. May be described with reference to the length of the working edge.

--See: Slicing and Scraping.
USE-WEAR

--Any flake scars, striations, grinding, or polishing produced by the use of an artifact as a tool. May overlay a retouched or an unretouched surface and edge.

--See: Retouch and Edge Damage.

--USE-WEAR TYPES

--Grinding: coarse abrasion.

--Nibbles: minute flake scars with feather terminations.

--Polish: a polished appearance to a surface.

--Snaps: semicircular, concave removal on an edge with a flat surface perpendicular to the flake plane. Also known as bending fractures, Lawrence (1979:115).

--Steps: scars caused by the breaking of a flake prior to termination. In appearance, a small ledge.

--Striations: scratches on the surface(s) of a tool. Caused by the interaction of a working edge with an abrasive particles. The abrasive particle may be either fixed in place or freely moving in relation to the working edge.

WAVES

--A flake attribute. The large concentric undulations present on a fracture face. Related to but larger than ripples (ripples overlay the waves). There may be five to six per fracture. More pronounced with hard hammer percussion. May be the equivalent of swells on the ocean.

--Similar to Crabtree's undulations (1972: 97).

WORKING EDGE

--The portion of a tool which has been used. Determined by observable use-wear or retouch morphology. It is possible for a single artifact to have more than one working edge.

--When more than one working edge is present on an artifact the relationship between the various edges may be of different types. On a hafted tool, such as a projectile point, the stem, or hafting area, may be considered a separate working edge from the blade. This relationship of working edges can be termed functionally symbiotic since the one working edge is dependent on the other. A relationship of working edges can be
termed similar when two or more working edges of the same type, i.e., two scraping edges, are present on an artifact. Finally, a relationship can be termed dissimilar when working edges of different types, i.e., slicing and scraping edges, are present on the same artifact.

--A different type of relationship altogether exists when a dysfunctional tool, for example a broken hafted scraper, is remanufactured into a projectile point. In this circumstance the fragmentary hafted scraper may be more properly considered the parent artifact of the projectile point.
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