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FROM DATA RECOVERY TO DATA ANALYSIS: PROJECTILE POINTS OF THE UPPER BASIN, KAIBAB NATIONAL FOREST, NORTHERN ARIZONA

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Nicholas C. Thompson

B.A., West Virginia University, 1994

Committee Chair: Dr. Alan P. Sullivan, III

Abstract

This exploratory analysis illustrates the advantages of non-destructive techniques by means of "on-site" data analysis of projectile points recorded by the Upper Basin Archaeological Research Project in the Kaibab National Forest, northern Arizona. The current data set consists of 362 drawings of projectile points and point fragments that were recorded during non-intrusive, double intensive surface-survey, from 1989 to 2002. The problem of this study is to determine whether the forms of isolated finds, i.e., projectile points recorded along survey transects, differ from those projectile points associated with concentrations of artifacts (referred to as a "mapping unit"). Understanding the origins of patterned differences between these two provenience types will provide inferences about land use in the project area, changing trends in projectile-point morphology, and the preferential treatment of raw material types in prehistoric projectile-point technologies.

The specific research objectives of this study are twofold. The first is to provide basic descriptive data on the projectile-point assemblage, which will enhance one's ability to conduct comparative studies, and second, where the analysis permits, the technological behavior of the Upper Basin tool makers will be interpreted. Although this research lacks the integrity of excavated material, the strength of this projectile-point data set is the large sample size and the range of morphological variation that the material provides. Therefore, this assemblage from the Upper Basin provides a unique opportunity to examine changes through time in projectile-point morphology, and to a lesser degree, changes in projectile-point technology.

Acknowledgments

On a personal level, I would like to express appreciation to friends and colleagues who encouraged me to continue my educational career. Without their support, the attainment of this degree would not have been possible.

On a professional level, I am indebted to my committee chair, Dr. Allan P. Sullivan, for the opportunity to study material from the Upper Basin Archaeological Research Project. I am grateful for the time he set aside to critique and edit this thesis, while making sure I remained focused on the proposed research design. The completion of this project would not have been possible without his support, patience, and commitment.

I also wish to thank Dr. Lynne A. Schepartz, my committee co-chair, for reviewing drafts of this manuscript in a relatively short period of time. She deserves special credit, for going out of her way to guarantee the completion of this thesis within the allotted timetable.

Finally, Patrick A. Uphus deserves special mention for taking the time to help remedy minor inconsistencies that were encountered during the construction of the projectile-point catalogue.

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Chapter 1

INTRODUCTION

The destruction of the archaeological record is an age-old problem that continues to accelerate at an increasing pace. Contributing factors are modern development, insufficient land management policies, and unrelenting artifact collection by non-professionals.

Although we cannot prevent these negative impacts on the archaeological surface record, as current practitioners of archaeology we can adjust our methods to preserve the interpretive potential of cultural-heritage resources for future generations and researchers. The goals of surface survey must include the protection of our heritage resources from "development" and archaeological research itself. Hence, we must practice methods of investigation that limit the further modification of the archaeological landscape. One solution is to collect archaeological material only when it is threatened by development, or only after an appropriate research design has been implemented. In other words,

> We must begin to understand that the archaeological record is a composition of distributions at many spatial and temporal scales superimposed one upon another. This realization will free us to characterize the archaeological record as the unitary and inseparable product of many millions of human events upon the landscape (Ebert 1992: xiv).

Another solution is to develop techniques of data collection that minimize the impact of archaeological investigation on the cultural landscape, such as exploring the usefulness of non-collection methods. This approach would ensure not only the proper management of cultural-heritage resources but also the protection of the surface archaeological record.

Problem Orientation

The following analysis of projectile points is proof that methods of on-site analysis have a central place in the future of archaeology. For if there are no resources, there can be no archaeology. Therefore, a goal of this research is to illustrate the dual advantages of non-destructive techniques by means of "on-site" data analysis of projectile points recorded by the Upper Basin Archaeological Research Project (UBARP) in the Kaibab National Forest, northern Arizona.

With this goal in mind, the problem of this thesis is to determine whether the forms of isolated finds, i.e., projectile points recorded along survey transects, differ from those projectile points associated with concentrations of artifacts (referred to as a "mapping unit"). Understanding the origins of patterned differences between these two provenience types will provide inferences about land use in the project area, changing trends in projectile-point morphology, and the preferential treatment of raw material types in prehistoric projectile-point technologies.

Scope of Thesis and Objectives

This thesis explores the potential sources of projectile-point variation as revealed by the archaeological surface record. The specific research objectives of this study are twofold. The first is to provide basic descriptive data on the projectile-point assemblage, which will enhance one's ability to conduct comparative studies[1], and second, where the analysis permits, the technological behavior of the Upper Basin tool

[1] Parry and Christenson (1987:43) correctly state that one particular problem with southwestern projectile-point studies is the lack of basic provenience and metric measurement data. So, other than providing a generalized impression of projectile-point morphology in a given area or time period, many studies that have been published are useless for comparative purposes. Another problem worth noting is the lack of consistency in the study of projectile-points, and the small sample sizes of excavated and surface material from the Upper Basin.

makers will be interpreted (Purtill [1995], for the analysis and interpretation of excavated projectile points of the UBARP study area).

Although this research lacks the integrity of excavated material, the strength of this projectile-point data set (n=362) is the large sample size and the range of morphological variation that the material provides. Therefore, this assemblage from the Upper Basin provides a unique opportunity to examine changes through time in projectile-point morphology, and to a lesser degree, changes in projectile-point technology.

A projectile-point is a biface that contains a haft element and is used as a projectile tip; these are often identified as arrow points, dart points, and spear points (Andrefsky 1998: xxvi). Projectile points are diagnostic multi-functional tools used mainly as hunting weapons and butchering implements that are morphologically dynamic articles of material culture (Andrefsky 1998:38). Basic differences in morphology are stylistic and the "spatial and temporal trends in point form are primarily generated by technological and ecological trends" (Christenson 1997:134).

In order to conduct a systematic analysis, a set of morphological projectile-point variables was constructed. Metric and non-metric attributes promote the organization of the recorded material into manageable units that warrant speculation about the cultural past. In doing so, the projectile-point assemblage was classified solely by base type categories.

As further research is conducted along these lines, the construction of a localized projectile-point typology is essential to the future of archaeology in this region, which serves not only as a crossroads to the Grand Canyon, but also as a route to the

Greater Southwest and the Great Basin. Instead of conveniently grouping this area with the surrounding geographical regions of the Southwest, as somehow floating between typological systems (see Justice 2002a and 2002b), the Upper Basin must be treated distinctly from the Greater Southwest and the Great Basin projectile-point systems. Only after such a strategy is embraced by practitioners of projectile-point typology, can the Southwest begin to break away from the broad overgeneralizations which encompass large geographical and cultural regions.

Thesis Organization

Following the introduction, this thesis consists of five chapters. Chapter 2 provides relevant background information on the environmental setting, a brief culture history of the Upper Basin, and a summary of the UBARP project. Chapter 3 defines the methods of projectile-point data recovery, the units of analysis, and projectile-point terminology. Chapter 4 presents the descriptive statistics for the metric and non-metric variables that measure variation for the complete projectile-point data set. Chapter 5 consists of a comparative analysis of metric and non-metric variables for projectile points recorded at transects and at mapping units, and among mapping-unit types. Chapter 6 summarizes the conclusions of the projectile-point analyses and finishes with a discussion concerning the potential of future research involving the UBARP projectile-point data set and non-collection methods.

Chapter 2

BACKGROUND

This chapter provides an overview of relevant background information regarding the environmental setting, the culture history of the Upper Basin, and a summary of the Upper Basin Archaeological Research Project.

Environmental Setting

UBARP is bounded by Grand Canyon National Park to the north and by the Coconino rim to the south (Fig. 2.1). The current survey area measures approximately 16.4 square kilometers. Situated on the southwestern corner of the Colorado Plateau in northern Arizona, the Upper Basin is a flexed, faulted, and tilted block of the Coconino Plateau covering approximately 363 square kilometers (140 square miles) (Barbenroth and Strahler 1945:135; Barnes 1987:381; Huntoon 1990:265). Ranging in elevation from 2,256 m (7,400 ft) along the South Rim of the Grand Canyon to 1,860 m (6,100 ft) near Lee Canyon (Sullivan et al. 2003:3), the entire area of the Upper Basin is underlain by the Kaibab limestone formation (Hopkins 1990). Visible just beneath the ground surface or eroding out of exposed slopes, this prominent geological feature enabled prehistoric peoples to acquire lithic materials in a variety of sizes. Ranging from pebbles to boulders (Rand 1965:73), the Kaibab formation provided diverse materials such as limestone for the construction of masonry structures, as well as Kaibab chert and calcareous sandstone for the production of chipped and ground stone tools (Brown 1969:171; Sullivan 1986:13).

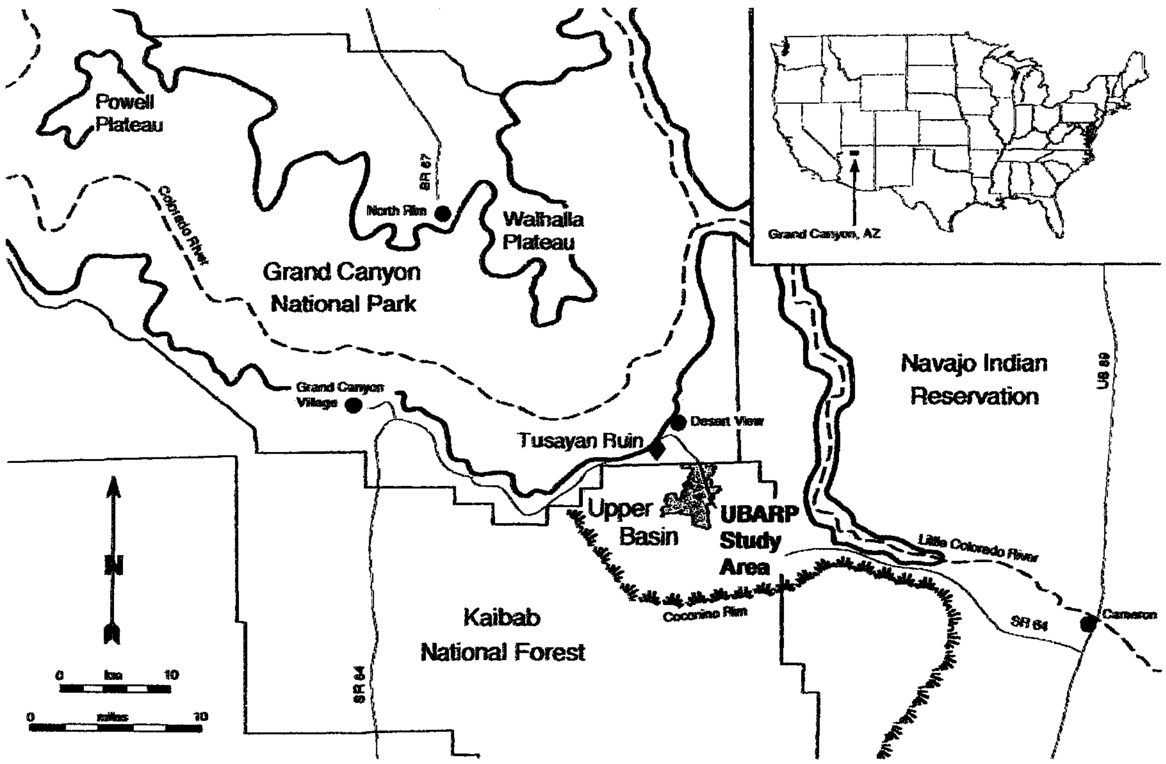

Figure 2.1: Regional map of Grand Canyon National Park and the UBARP study area.

Having remained relatively unchanged for more than 1,000 years (Sullivan 1986:17), this stable sagebrush, pinyon, and juniper habitat[2] offered a wide range of resources for the prehistoric peoples who hunted and settled here. Visible throughout the landscape, there is wood from the extensive pinyon-juniper woodland for construction and fuel (for additional applications see Sullivan 1986:18-20), pinyon nuts, goosefoot (*Chenopodium*) and amaranth (*Amaranthus*) for food (Sullivan 1996:155), and an abundance of wild game[3].

Cultural History

In the most general sense, the three main temporal periods represented by the UBARP projectile-point sample are the Archaic Period (ca. 2000 B.C.-A.D. 700), the Pueblo Period (ca. A.D. 700-A.D. 1300), and the Proto-historic Period (post-A.D. 1300). In theory, unique to each of these periods is the manufacture of diagnostic projectile points that were stylistically distinct.

Archaic Period (ca. 2000 B.C. – A.D. 700)

Relatively limited research conducted in the Grand Canyon region has focused on the Archaic populations. McNutt and Euler (1966) reported on projectile points from the vicinity of Red Butte, and Jennings (1971) conducted excavations south of the Grand Canyon on the Coconino Plateau that yielded stone tools of this period. In addition, split-twig figurines dated as early as 2145 B.C (Euler 1983:67), have been recovered in

[2] Spatial information on soils and vegetation divides the project area into three ecological zones: a mixed ecozone (54%), a wooded ecozone (34%), and a sage ecozone (12%) (Sullivan et al. 2003: 9). Preliminary spatial analysis seems to suggest that the highest densities of projectile-points are located in areas of transition from one ecozone to the next.
[3] Archaeologically recovered faunal remains from this region include deer, woodrats, jackrabbits, and cottontails (Sullivan 1986:20).

isolated caves of the Grand Canyon, and are commonly referred to as the earliest remnants of Archaic occupation in this region (Schwartz 1988:14).

The spear points[4], the stone debris left from fashioning them, and milling stones are primarily the only evidence of Archaic occupation (Reid and Whittlesey 1997:54). Regrettably, this situation is not easily remedied, as Archaic projectile points regardless of type are usually recorded as isolated surface finds or at limited activity areas. Even after excavation, the latter may provide little information about this period beyond that available from the surface material.

The Archaic projectile-point types of the UBARP sample were recorded at transects, lithic scatters, and sherd and lithic scatters. Typically, projectiles of this period were hafted as darts and propelled by a spear-thrower, or *atlatl* (Kidder 2000:34). It is not until the end of the Archaic Period, about A.D. 700, that the bow was introduced into this region of the Southwest. Holmer (1986:106) attributes this change in technology to the appearance of small points. This claim is supported by the Black Mesa projectile-point data set, which indicates a shift in technology in the Kayenta region sometime between the Basketmaker II and Early Ceramic Period, resulting in the reduction of most projectile-point dimensions (Parry and Christenson 1987:155).

That this shift in morphology may have coincided with a new hafting technique as readily observable in UBARP projectile-point data set (Fig. 2.2). Whereas the Archaic period hunters produced large basal-notched, side-notched, corner-notched and stemmed base types, the transitional Basketmaker peoples retained the large side-notched and corner-notched projectile points, but also utilized a smaller corner-notched

[4] "The significance of projectile points is magnified as one goes back in time, as they represent the only known way of identifying some Preceramic manifestations" (Parry and Christenson 1987:143).

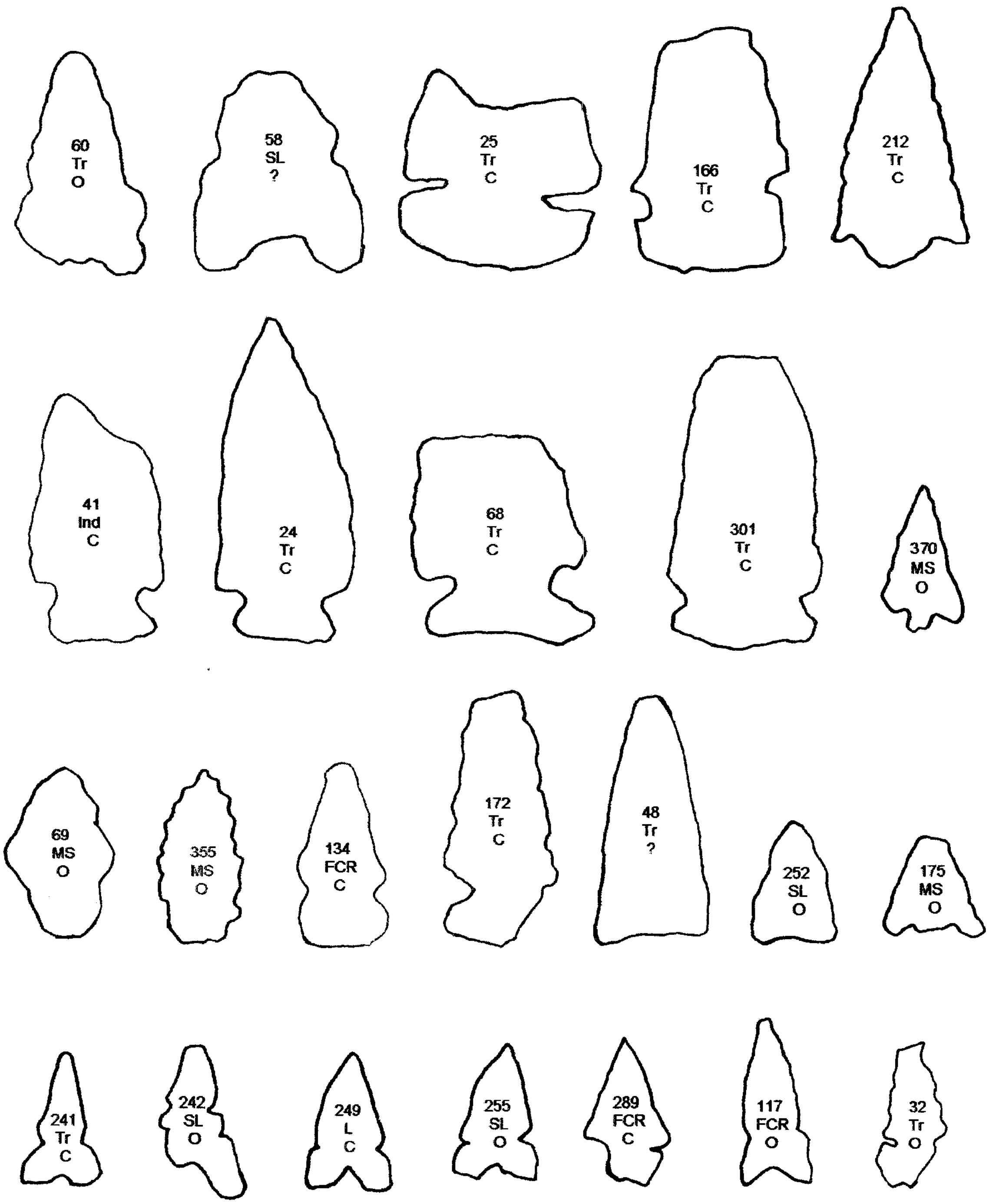

Figure 2.2: Examples of UBARP projectile points organized by temporal period. Top row: Archaic Period, Second row: Basketmaker Period, Third row: Ceramic Period, and Bottom row: Proto-historic Period.

projectile point.

Ceramic Period (A.D. 700 – 1300)

During the Ceramic Period, the inner Grand Canyon and the Coconino Plateau region were occupied by two cultural groups: the Cohonina and Anasazi. Schwartz et al. (1979:85) states that the first evidence of more permanent settlements occurred on the South Rim from about A.D. 700 and on the North Rim from A.D. 900. Over the next 150 years, as the Rim population reached its greatest density, both the number and size of sites in the Grand Canyon region increased (Schwartz et al. 1979:85). During this later period, architecture became more formalized, and the masonry structure (see Uphus 2003) developed into the trademark of the Pueblo people.

A good deal of current research of this period has focused on the Cohonina distribution in relation to the Anasazi occupation (Rice et al. 1980:22). One recent theory involving differential land use of the Upper Basin states that the consequent and more extensive Anasazi occupation of this region was restricted somewhat by the earlier Cohonina settlement (Sullivan et al. 2003:9). The ending date of the Ceramic Period occurred between A.D. 1200/1300 when, for reasons that remain obscure, most of the Grand Canyon and the plateaus were abandoned (Euler 1969:8; Schwartz 1988:14).

Projectile points of this period were recorded at all provenience types[5] and in all likelihood make up the largest percentage of the UBARP projectile-point sample (see Anderson (1990), James (1977), and Parry and Christenson (1987) for excavated material of the Ceramic Period). The typical projectile points of this period are small side-notched, small stemmed, corner-notched, and unnotched base types (Fig. 2.2).

[5] The unnotched base type was not recorded at masonry structures.

Proto-historic Period (post-A.D. 1300)

The Proto-historic period is characterized by various cultural groups who temporarily exploited the various resources of the Upper Basin (Sullivan et al. in press). The most notable of these various Pai cultures are the Havasupai and the Hopi (Sullivan 1986). It has been suggested that during this period the Hopi not only maintained trade relations with the Havasupai in the Upper Basin, but also considered the area to have important ceremonial and natural resources (Rice et al. 1980:23).

Purtill (1995:134), who conducted an analysis of excavated lithic materials from UBARP, suggests that "migrating Late Prehistoric and the Proto-historic populations re-occupied sites such as fire-cracked-rock piles and sherd and lithic scatters more readily than masonry structures". This pattern, one that he and Sullivan et al. (1994) suggest is deliberate avoidance, appears to be strengthened by the UBARP surface material, as the majority of Proto-historic projectile points are recorded at lithic scatters, sherd and lithic scatters, transects, and at a couple of FCR-piles. The typical projectile point of this period is small and basal-notched (Fig. 2.2).

Summary of UBARP

Since 1989, in an attempt to reconstruct prehistoric land-use strategies and subsistence economies for the Upper Basin, UBARP has conducted a number of surveys and excavations (Table 2.1) in the Kaibab National Forest, northern Arizona. During the years of continuous field-work "considerable diversity not only between site types (e.g., masonry pueblos versus FCR-pile sites), but also among site types (e.g., FCR-pile sites) has been uncovered" (Purtill 1995:3). Of the excavated mapping units, only three (MUs 123, 235, and 236) have projectile points recorded on the surface that are included in this

Table 2.1: Summary of the UBARP field seasons from 1989-2002 including surface survey and site excavation.

Year	Survey	Excavation
1989	Yes	No
1990	"	MU 235
1991	"	MU 235, 236, 38
1992	"	MU 125
1993	"	MU 125A
1994	"	MU 121, 123.1, 125
1995	"	MU 123.2, 125
1996	"	MU 125
1997	"	No
1998	No	No
1999	Yes	No
2000	"	Simkins Flat
2001	"	No
2002	"	Simkins Flat

data set.

Even though surface survey can be a reliable indicator of subsurface data (Simmons 1988:160), once a mapping unit is revisited, or the trowel placed into the ground, a reevaluation of the initial mapping unit may take place. Instead of disregarding the data recorded at mapping-unit types that either changed initial mapping-unit type designations, or were later designated as multiple mapping units, a new category was created. Therefore, the "indeterminate" mapping-unit type was incorporated into the UBARP projectile-point database (refer to Appendix B, Non-metric variables: mu type 5.00).

In general, it is interesting to note that over the years as the number of mapping units resurveyed increased, initial designations have in most cases remained unchanged. Also, in the earlier years of field-work, when the focus was mainly on surface survey, the numbers of projectile points recorded along transects was much higher, as were the totals of projectile points recorded for each field season. When previously discovered sites were revisited, only in a few cases have the frequencies of projectile-points increased dramatically, if at all.

One interesting observation is that, of the 362 projectile points in this sample, only four have been rerecorded, three at mapping units and one along a survey transect. Also, the large size of the UBARP assemblage means that data are available to warrant speculation regarding artifact variability.

Chapter 3

METHODOLOGY

A specific objective in archaeology is to interpret observations correctly and to group recorded data into manageable units that warrant inferences about the cultural past. In this exploratory analysis, based on a data set collected by non-intrusive, low-impact surface-survey, I will construct hypotheses from the selected attributes, and test the inferential potential of the data set when sufficient variation warrants the application of statistics.

The current data set consists of 362 drawings of projectile points and point fragments that were recorded during double intensive[6] surface-survey of the Upper Basin, Kaibab National Forest, from 1989 to 2002. The projectile-point catalogue is compiled from field-notebooks, and the units of observation for the study of projectile point variation are mapping units and isolated projectile points recorded along survey transects.

A mapping unit[7] (MU) refers to an observable archaeological phenomenon on the landscape, such as a masonry structure, fire-cracked-rock pile, lithic scatter, or sherd and lithic scatter, whose origins cannot be attributed to natural processes (Sullivan et al. 2002:43). Using GPS technology, the UBARP survey plots the location of all modern and prehistoric anthropogenic impacts on the landscape. Currently, the locations of 945 prehistoric MUs have been recorded. A total of 211 projectile points have been recorded at 171 mapping units (Fig. 3.1). A transect, on the other hand, is a compass bearing that

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[6] "Double intensive survey means that the same terrain has been surveyed at least twice by crew spaced about 10 meters apart" (Sullivan et al. 2002:43).

[7] The conventional term "site" is problematic because it does not take into account the possibility of a protohistoric feature intruded into or upon a prehistoric concentration of artifacts: "the MU concept allows variability to be recorded unambiguously" (Sullivan et al. 2003:6).

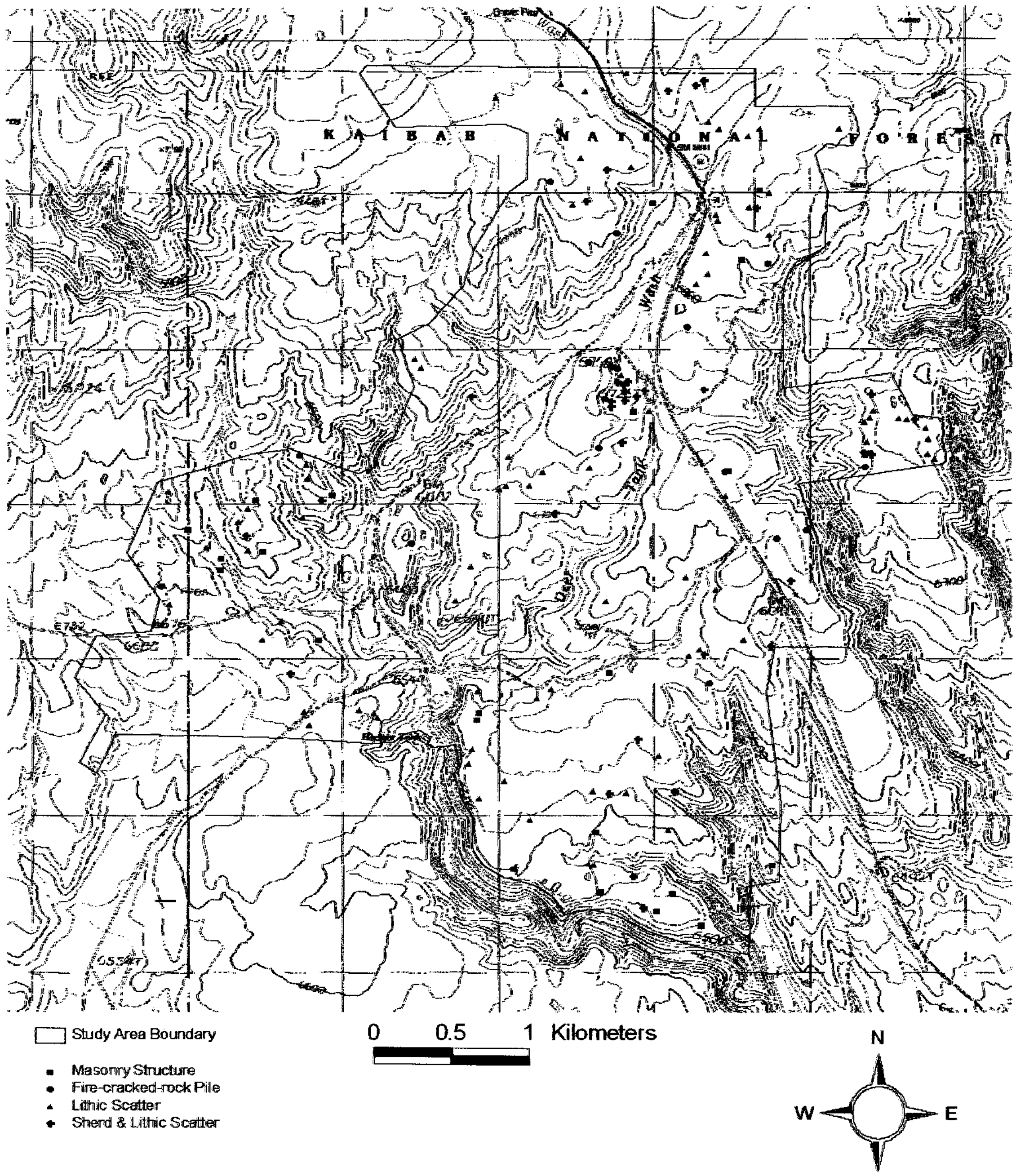


Figure 3.1: Spatial distribution of mapping units with projectile points.

survey crews walk as they conduct surface survey. For the purposes of this study, a transect refers to the provenience of projectile-points that were recorded as isolated finds (n=151).

On-Site Analysis

As "the starting point of all archaeological research and the basis for which most federal heritage resource management decisions are made" (Sullivan et al. 2002:44) surface survey lends itself not only to conservation, but also to the collection of data that have intrinsic research value. One non-destructive approach to data recovery is on-site analysis, a method in which analytical procedures typically reserved for the laboratory are conducted in the field (Beck and Jones 1994:304)[8].

In particular, on-site analysis of lithic artifacts provides invaluable insights into the reconstruction of the archaeological record without destroying the cultural-heritage resources themselves. Information collected during UBARP on-site analysis includes a scale drawing of the projectile-point and a designation of material type.

Projectile-Point Attributes

A primary goal of archaeological research is "the reduction of artifact variability into classes [that] aid in the understanding of phenomena being investigated" (Andrefsky 1998:59). In the archaeological record, variables are measured and compared for the purpose of discovering general relationships among cases from which hypotheses can be tested (Watson et al. 1984:172).

[8] "It cannot be overemphasized that collecting artifacts from archaeological sites is destructive of most of the information we are seeking to preserve, reconstruct, and appreciate" (Kooyman 2000:4).

In general, this projectile-point data consists of artifact tool types that were designated as projectile points in the field during the initial phases of data collection. If a designation appeared questionable, because the artifact was either too fragmentary, or contained no haft element, or clearly another tool type, this artifact was not included in the UBARP projectile-point database.

Metric Variables

Metric variables promote a consistent and standardized process for the identification of projectile points (Beck and Jones 1990:308), while creating a statistical database of projectile-point morphology (Justice 2002a:16). These measures also facilitate the construction of comparative projectile-point models that have the potential to test technological change and temporal preference of raw material types among distinct projectile-point types and cultural periods.

The following metric attributes (Fig. 3.2) were chosen because they concisely and accurately represent the basic features of the biface. Recorded to the nearest millimeter, are maximum length, maximum width, maximum base width, maximum base length, and maximum notch width. Maximum measurements refer to estimates of complete projectile points from fragmentary material. These estimates occur only when the fragmentary material allows for a reliable complete measurement.

Terminology

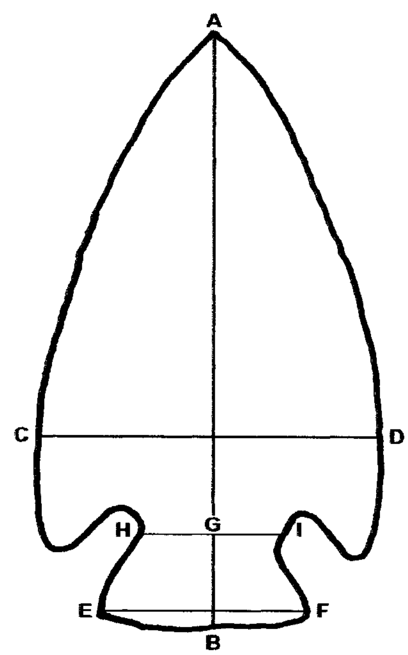
1. *Maximum Length*: refers to the longest distance measurable from the tip to the edge of the base. In most cases, this measurement was taken along the central axis, with the exception of basal-notched and concave projectile points that were measured at the longest distance that parallels the central axis.

2. *Maximum Width*: refers to the widest lateral distance measurable of the point that is perpendicular to the central axis.

3. *Maximum Base Width*: refers to the widest lateral distance measurable of the haft element that is perpendicular to the point's central axis. This measure is not applicable to unnotched points.

4. *Maximum Base Length*: refers to the longest distance measurable of the stem that parallels the central axis of the biface. This measure is not applicable to unnotched points.

5. *Maximum Notch Width*: refers to the distance between the two most invasive points of the lateral notches. This measure is not applicable to unnotched points.



A to B = Maximum Length
C to D = Maximum Width
E to F = Maximum Base Width
G to B = Maximum Base Length
H to I = Maximum Notch Width

Figure 3.2: Diagram of projectile-point metric attributes.

Non-metric Variables

The non-metric variables selected for this analysis are condition, material type, and base type.

Condition

For the purposes of this study, a projectile point consists of three elements: a base (hafting element), a body (the distal half of the blade that attaches to the base), and the tip of the blade. Condition measures projectile-point completeness by means of six categories (Fig. 3.3) ranging from 0.5 (most fragmentary) to 3.0 (complete). This numeric scale captures the completeness of the bifacial tool the moment it was recorded by the UBARP surveyors, which is not necessarily the condition of tool at the moment of discard. Post-depositional factors may also influence the completeness of the artifact before data recovery. One such example is the trampling of surface material by animals and human activity, a consequence which may not always be easy to distinguish from systemic behavior.

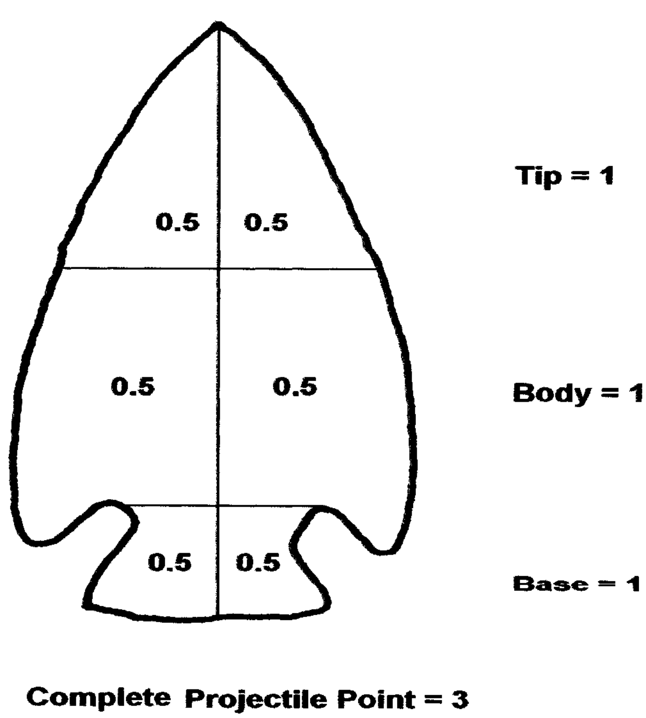


Figure 3.3: Diagram of projectile-point condition scale.

Many different factors influence the final deposition a projectile point. Without getting into detail about types of reuse (Schiffer 1976:38), I assume that the systemic use of projectile points was for hunting (Justice 2002a:2; Schlanger 1992:107; Martin and Plog 1973:218). Therefore, it seems logical to assume that the points found along transects as isolated finds were lost during hunting (primary use), and those recorded at mapping units were either discarded before use, after initial use, or recycled and discarded after secondary use[9]. This assumption is supported by the data set where higher frequencies of complete projectile points occur at mapping units, in contrast to the higher frequencies of fragmentary material at transects (Fig. 3.4).

Material Type

Variation in the material type frequencies reflects patterns in resource procurement, contact, and trade (Justice 2002a:27; Kooyman 2000:136). For the purposes of this analysis, material types have been grouped into three categories: 1) Chert, 2) Obsidian, and 3) Other. The raw materials utilized most frequently for the manufacture of projectile-points in the UBARP study area are Kaibab chert and obsidian. The raw material types utilized less intensively, grouped into the category of 'other,' are chalcedony, rhyolite, quartzite, schist, basalt, non-local chert, and petrified wood.

Chert is a cryptocrystalline or microcrystalline variety of quartz, originating from a sedimentary context (Andrefsky 1998: xxii). The local variety, widespread in the Upper Basin, is located in nodular and bedded deposits that erode out of Kaibab limestone (McGregor 1951:111). The most common colors of Kaibab chert identified in

[9] Secondary use and scavenging refer to both reuse and recycling, whereas discarded materials that have not undergone secondary use are considered as entering into an archaeological context (Camilli and Ebert 1992:120).

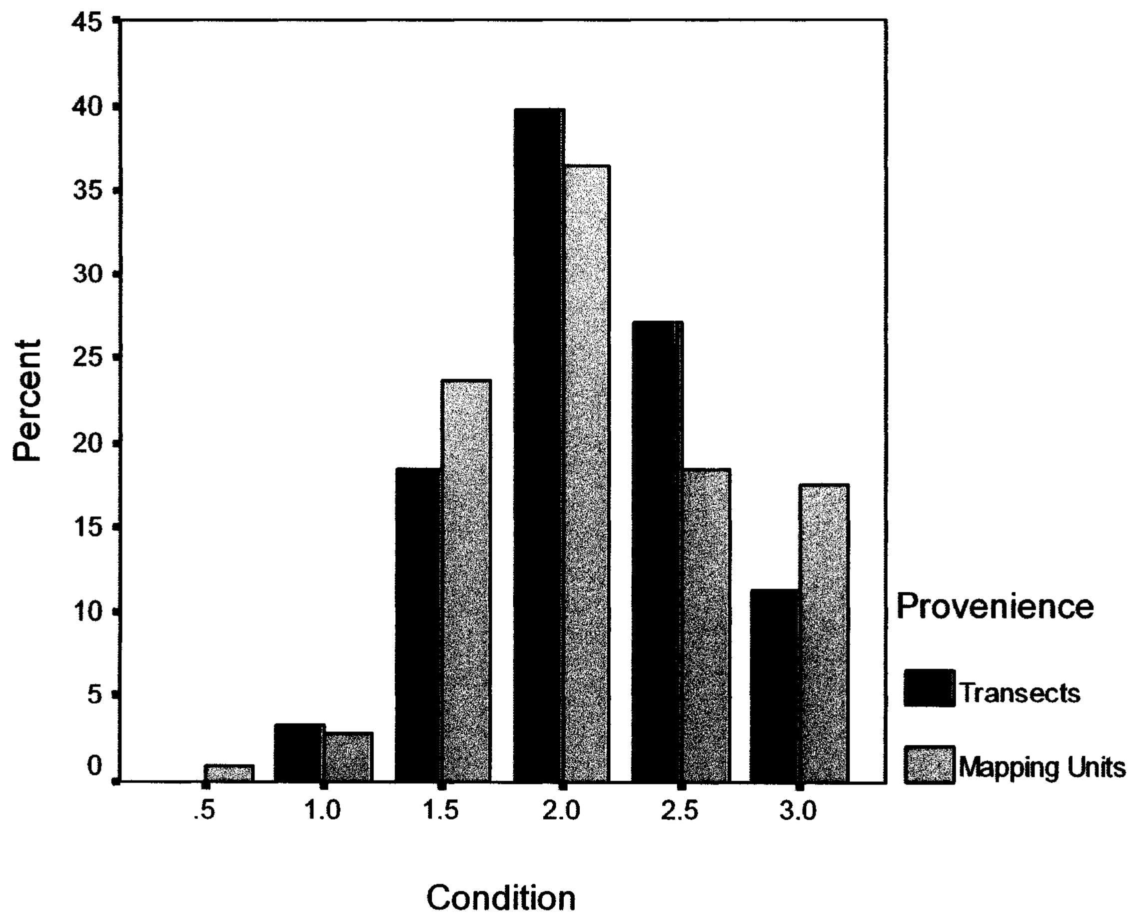


Figure 3.4: Clustered bar chart of projectile-point condition at transects and mapping units.

the UBARP sample are the red, white, orange, and gray varieties[10]. Unless the field description indicated a non-local origin, all chert types were considered of the Kaibab variety.

Obsidian, a volcanic rock formed into natural glass of the same chemical composition as granite or rhyolite (Kooyman 2000:175), occurs most frequently in varieties of black, gray, and gray/black. The closest major[11] sources are located at least 90 km from the project area in the San Francisco Mountain and Mount Floyd volcanic fields (Fig. 3.5).

Shackley (1988) and Lesko (1989) have conducted geochemical and descriptive comparative analyses of the major obsidian sources located on the Coconino Plateau, northern Arizona. Although no such analysis has occurred with regard to the UBARP material, Lesko mentions that "Partridge Creek obsidian was found in archaeological context in all four districts of the Kaibab National Forest and on sites within Grand Canyon National Park" (Lesko 1989:394). Given this known range, and the visual attributes of the source materials, it seems likely that the obsidian utilized for projectile-point manufacture in the Upper Basin is from the San Francisco Mountain (Government Mountain) and Mount Floyd volcanic fields (Partridge Creek and Presley Wash).

The varieties of black obsidian originate from sources at Partridge Creek and Government Mountain which is the most exploited and well known source. Partridge

[10] A variety of mixed Kaibab chert colors were also recorded by survey crews, as were material type descriptions that lacked color designation, although in these instances the material type was designated as Kaibab chert. With such range of descriptive variation it would be interesting to investigate whether this variability occurs naturally or is the result of heat treatment (for visible properties of heat-treated chert, see Luedtke 1992:103-105).

[11] McNutt and Euler (1966:410) indicate a source at Red Butte located near the Grand Canyon associated with Archaic projectile points. This secondary source, while questionable, may have important implications to the future interpretation of resource procurement in the Upper Basin.

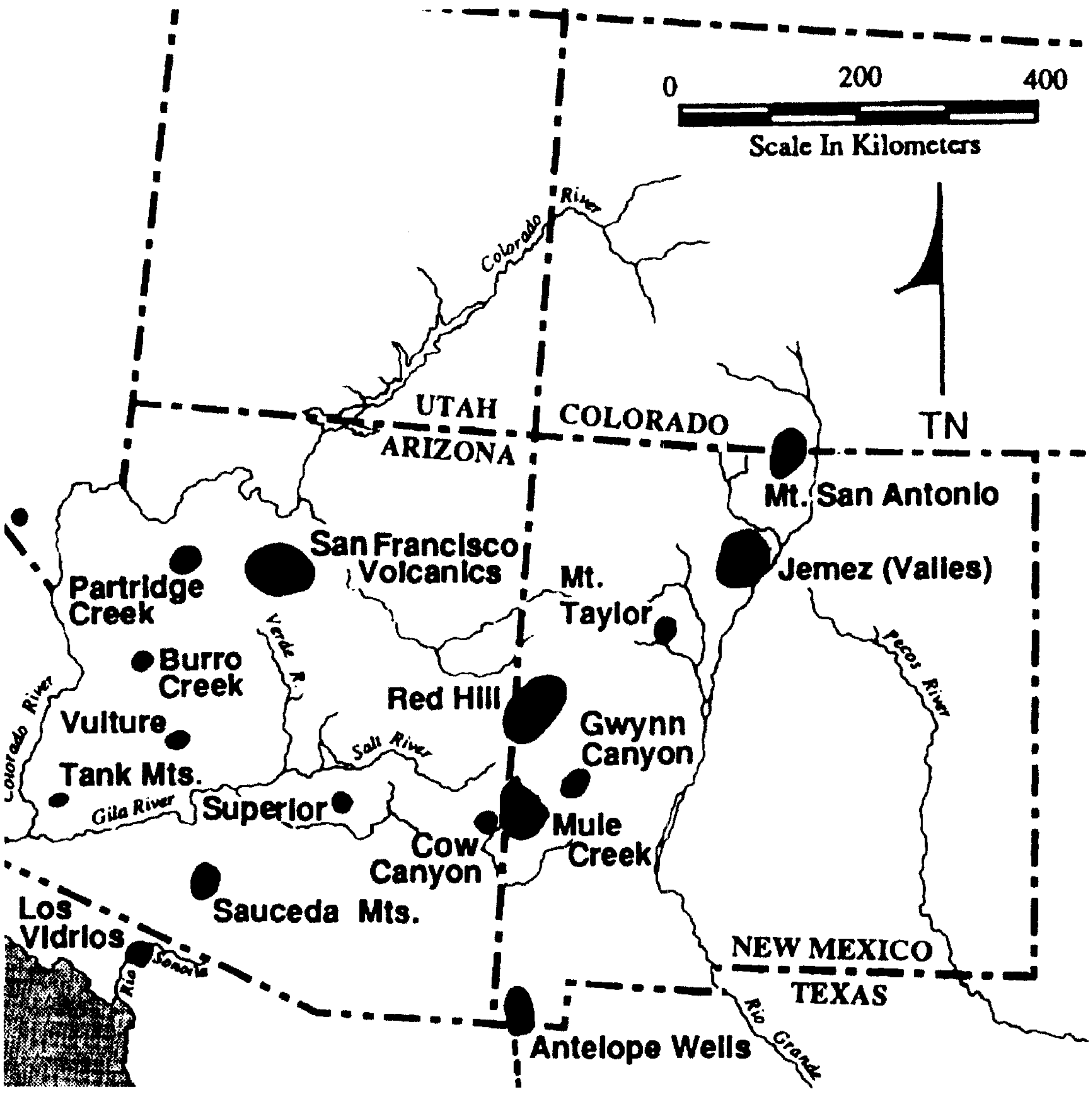


Figure 3.5: General location of obsidian sources in the American Southwest. Partridge Creek (Mount Floyd Volcanic Field) and San Francisco Volcanics are considered the likely sources of obsidian utilized in the manufacture of projectile points within the vicinity of Grand Canyon and the UBARP survey area (adapted from Shackley 1995:532).

Creek is black and glassy and is found in small elongated lenses mixed with ash at the primary geological source (Lesko 1989:388); and occurs in nodular form at secondary deposits along the Partridge Creek drainage (Shackley 1988:755). Presley Wash, the only known source of gray obsidian that occurs on the Coconino Plateau, is opaque gray to gray-green and is often streaked with black bands (Lesko 1989:389). The black streaks on the material guarantee proper identification as this variety could be mistaken for gray chert (McGregor 1967).

Base Type

Base type is an important variable because the hafting element is an essential component of a projectile that distinguishes this tool type from other bifacial tool types. This variable is also significant because it allows for the construction of a classification scheme that permits correct assignment of projectile-point types.

If projectile points are used primarily for hunting, the morphology of the hafting element may change over time in response to function (e.g., spear point, dart point, and arrow point), hafting technique, and by the availability and quality of raw materials. The categories of base type are 1) side-notched, 2) corner-notched, 3) unnotched (stemless), 4) stemmed, and 5) basal-notched.

Base Type Terminology (refer to Fig. 3.6)

Base Type 1. *Side-Notched*: refers to a projectile point that is notched on the side; the base width in most cases is greater or equal to the blade width.

Base Type 2. *Corner-Notched*: refers to a projectile point that is notched at the corners of the base; the base width is less than the blade width.

Base Type 3. *Unnotched*: refers to a projectile point that has no visible notches, the haft element occurs flat, concave, or convex.

Base Type 4. *Stemmed*: refers to a projectile point that is notchless, and retains a haft element that is straight, contracting, or expanding.

Base Type 5. *Basal-Notched*: refers to a projectile a point that is indented at the base, occurs as a single (bifurcate) or double notch.

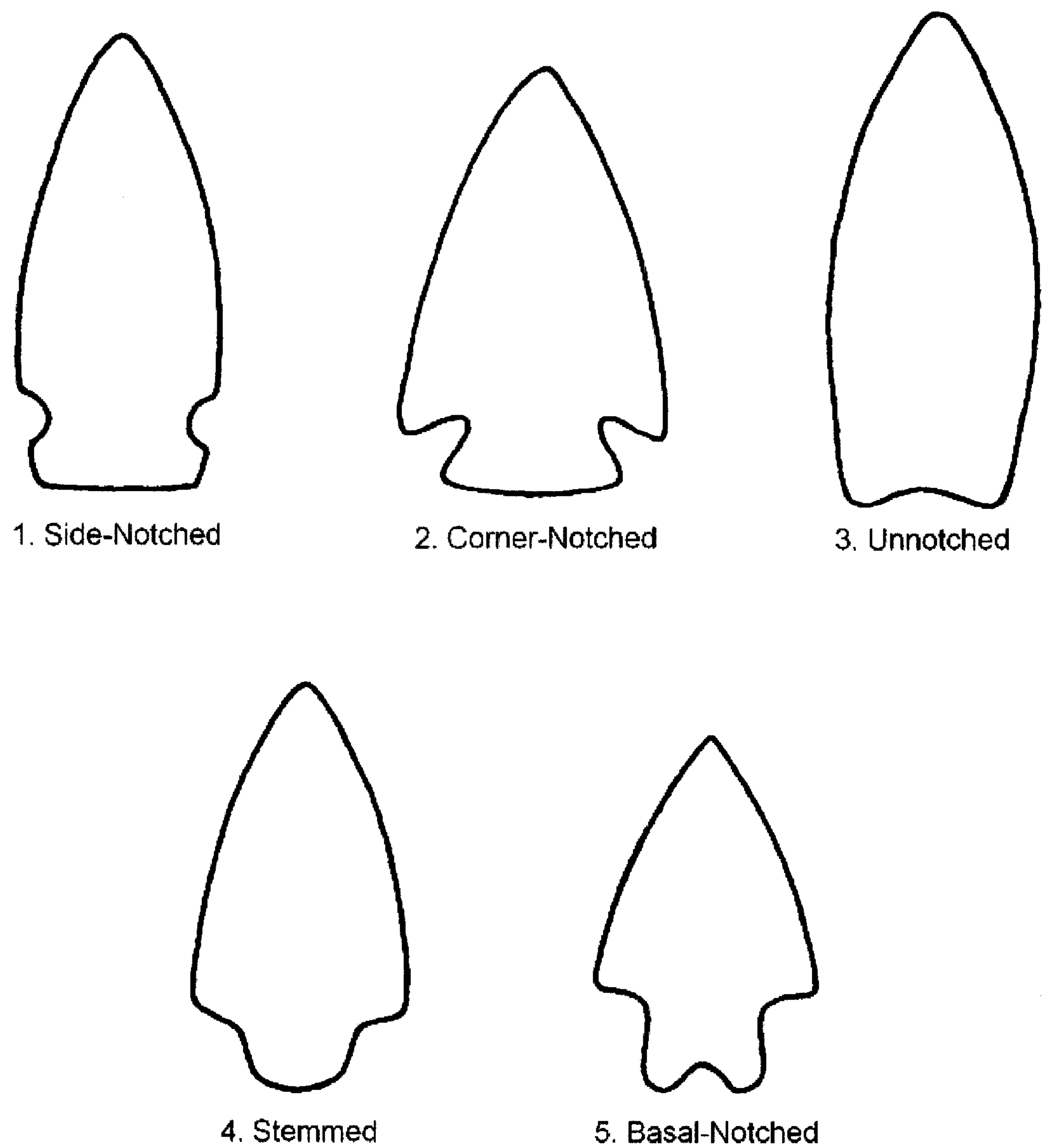


Figure 3.6: Base type classification scheme (adapted from Holmer 1980:70).

Chapter 4

DATA ANALYSIS

In this chapter, I describe projectile-point variation. This presentation will set the stage for the interpretation of formal variation between projectile points recorded at mapping units, at transects, and among mapping-unit types in Chapter 5.

Metric Variables

The metric variables of the complete sample provide valuable descriptive (Table A.1) and inferential data that promote comparative regional analyses of projectile-point morphology[12].

The Relation between Projectile-Point Form and Material Type:

One factor that determines the variability of projectile-point morphology is the abundance of lithic raw materials (Andrefsky 1998:38; Jelinek 1976:24; Whittaker 1994:270)[13]. To test this assumption, a T-test (Table 4.1) was applied to determine whether raw material types influence projectile-point form[14]. The results indicate significant differences between the maximum length, maximum width, and maximum notch width of chert and obsidian projectile points.

Chert projectile points have the largest means, have greater ranges, and include the largest maximum projectile point measure in every metric variable category. Hence, the data and tests support the assertion that projectile-point size is related to raw material type.

[12] Tables A.2 - A.6 and Figures A.1 - A.5 illustrate the frequency distribution of each metric variable.
[13] Raw material types "limit the size of tools that can be made depending on the size the pieces of stone comes in (e.g., river pebbles versus 40m thick beds)" (Kooyman 2000:98).
[14] Due to the small sample size of the category 'other,' these material types were excluded from the T-test.

Table 4.1: Descriptive statistics and T-test of metric projectile-point variables between chert and obsidian.

		Material Type	n	Range (mm)	Minimum (mm)	Maximum (mm)	Mean (mm)	Std. Deviation (mm)	t	df	Sig. (2-tailed)
maximum length (mm)	equal variances not assumed	Chert	72	47	16	63	32.51	8.98			
		Obsidian	44	28	15	43	26.52	6.66	**4.107**	109.613	**.000**
maximum width (mm)	equal variances not assumed	Chert	162	40	7	47	19.29	5.27			
		Obsidian	75	19	8	27	16.47	4.59	**4.197**	163.689	**.000**
maximum basal width (mm)	equal variances not assumed	Chert	167	35	3	38	15.92	4.78			
		Obsidian	73	24	4	28	14.99	4.96	1.359	132.825	.176
maximum basal length (mm)	equal variances not assumed	Chert	164	12	2	14	6.56	1.96			
		Obsidian	73	8	3	11	6.23	1.67	1.32	160.855	.189
maximum notch width (mm)	equal variances not assumed	Chert	135	19	5	24	12.27	3.14			
		Obsidian	64	18	3	21	10.89	3.11	**2.908**	125.047	**.004**

Non-Metric Variables

Condition

Of the total sample, (Fig. 4.1) 54 points are complete (15%) and 308 are fragmentary (85%). However, with a mean value of 2.11 (out of 3.0), the recorded projectile points are likely to be more complete rather than more fragmentary.

Material Type

The preferred material for the manufacture of projectile points within the UBARP project area is Kaibab chert. Figure 4.2 indicates that local chert was utilized nearly twice as intensively as the higher quality non-local obsidian. This distribution is consistent with other prehistoric strategies of raw material utilization in northern Arizona, such as Black Mesa (Parry and Christenson 1987) and Wupatki (Anderson 1990).

In previous studies in the Upper Basin, the percentage of obsidian is less than 5% (Rice et al. 1980:47). Such low frequencies do not even approach those for the UBARP study area. This disparity exemplifies the relevance of high-intensity survey in the construction of appropriate regional models that accurately represent the local archaeological surface record. The high percentages of obsidian in this region of the Upper Basin suggest sustained contact and possible trade with peoples to the south and west of the Upper Basin.

Base Type

Typically, the base type of a projectile point is considered a stylistic modification that is attributable to function and temporal preference. Table 4.2 indicates that side-notched (44%) projectile points are by far the most common, which may be an

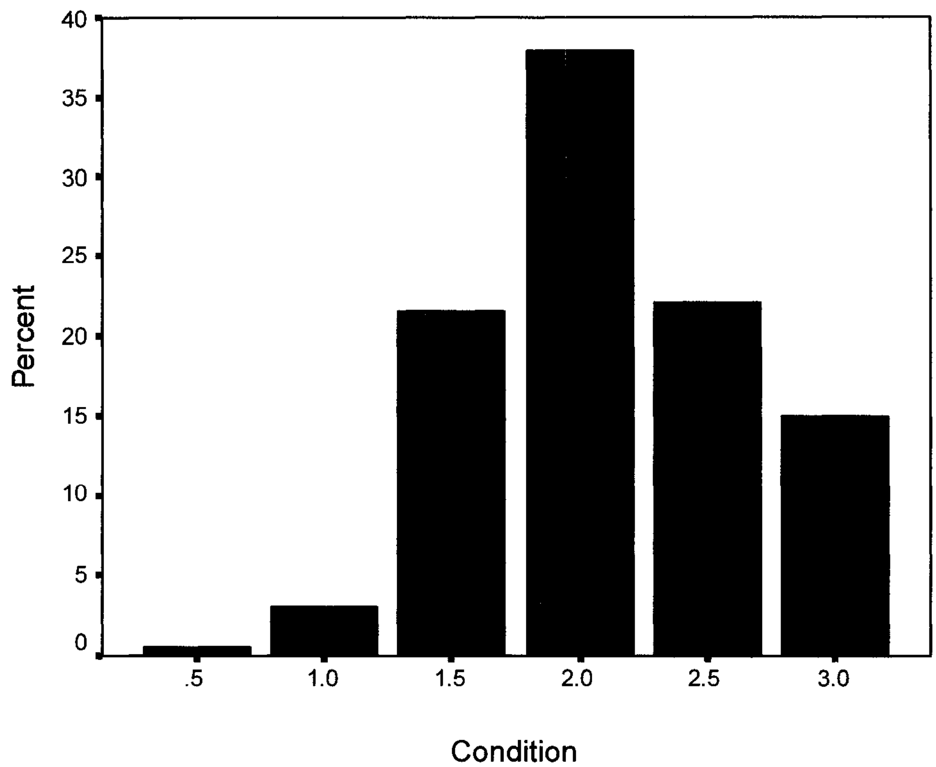


Figure 4.1: Bar chart of the condition frequencies of the projectile-point sample.

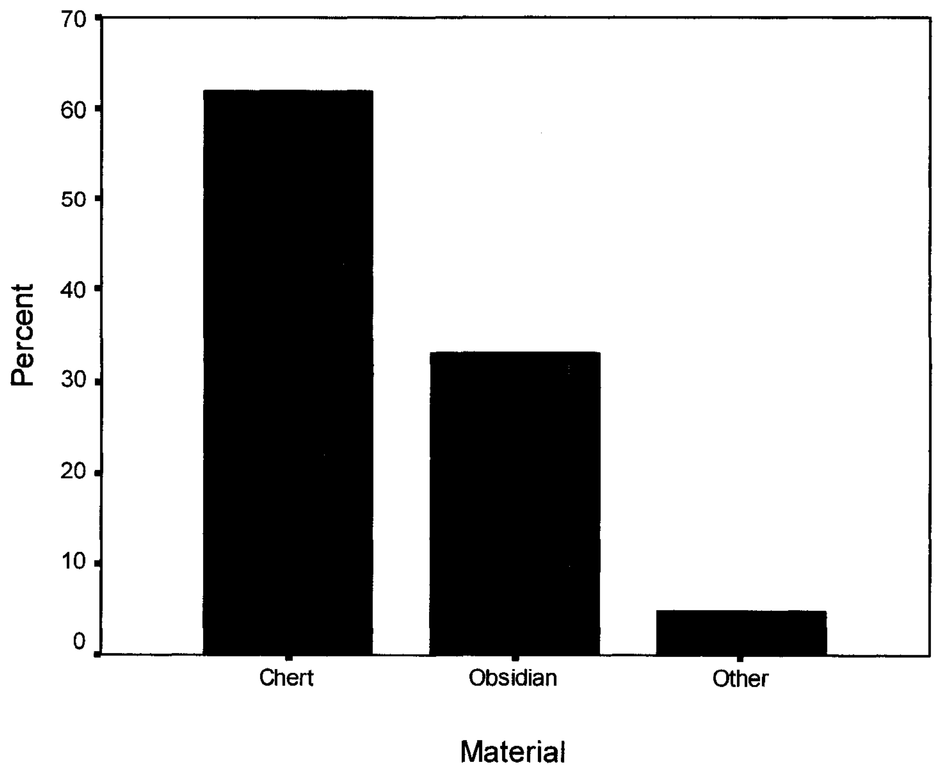


Figure 4.2: Bar chart of material type frequencies of the projectile-point sample.

Table 4.2: Base type frequencies of the complete projectile-point sample.

		Frequency	Percent	Valid Percent	Cumulative Percent
	Side Notched	152	42.0	43.9	43.9
	Corner Notched	89	24.6	25.7	69.7
	Unnotched	12	3.3	3.5	73.1
	Stemmed	55	15.2	15.9	89.0
	Basal Notched	38	10.5	11.0	100.0
	Total	346	95.6	100.0	
	Unknown	16	4.4		
Total		362	100.0		

indication of their effectiveness in hunting. Woodbury (1954:121) states a similar conclusion about side-notched projectile points from the Jeddito district of northeastern Arizona during the Basketmaker and Pueblo periods. The next most frequent base types are corner-notched (26%), followed by stemmed (16%), basal-notched (11%), and the least frequent base type, unnotched (3%) or stemless.

The Relation between Base Type and Material Type

Figure 4.3 compares the material type and base type frequencies. With regard to the most frequent base type categories, chert was by far the preferred material type for corner-notched (72%), stemmed (68%), and side-notched (63%) projectile points. Unnotched (55%) and basal-notched (46%) projectile points demonstrate a considerably lower preference of chert. Obsidian is more frequent than chert only for basal-notched (49%) projectile points.

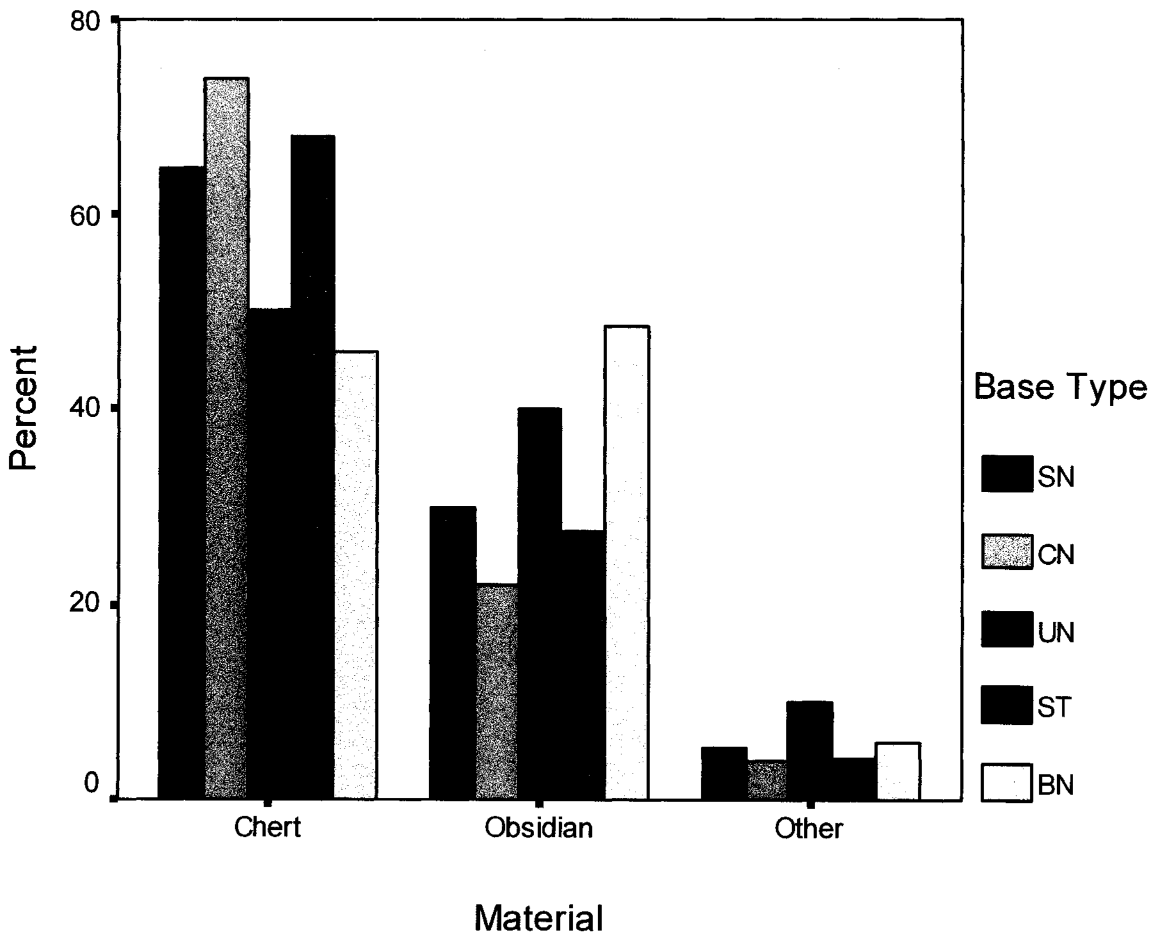


Figure 4.3: Clustered bar chart of projectile-point material type and base type frequencies.

Chapter 5

INTERPRETATIONS

In an attempt to further isolate sources of variation in projectile-point morphology, this chapter focuses on the comparative analysis of projectile points recorded at mapping units and along survey transects. It will begin with the analysis of metric and non-metric variables, and will conclude with hypothesis testing of projectile-point formal variability among transects, mapping units, and mapping-unit types.

Provenience

Table 5.1 indicates that 57% of the projectile-point sample was recorded at mapping units[15] and 43% along survey transects. The highest density of mapping units with projectile points (see Fig. 3.1) is located along the western edge of Deer Tank Wash, the major drainage that flows through the UBARP study area. Further investigation involving the spatial analysis of projectile-point densities may clarify whether this pattern is a consequence of systemic behavior or random spatial patterning. One preliminary inference of systemic behavior that may explain this distribution relates to the surrounding topography, which may have allowed hunters to take advantage of the prominent ridge tops and the steep slopes of the wash to drive or ambush larger game.

When compared to similar projectile-point studies (see Schlanger 1992:91-112), the UBARP projectile-point densities at mapping units (Fig. 5.1) are considerably lower. Whereas Schlanger recorded caches of projectile points as high as 13 and 23 per "persistent place," the UBARP survey recorded no more than three projectile points at a

[15] Of the total of 211 projectile points recorded at mapping units, only 19% (n=41) were recorded with multiple projectile-point assemblages.

Table 5.1: Projectile-point frequencies recorded by provenience type.

PROVENIENCE		Frequency	Percent	Valid Percent	Cumulative Percent
	Transect	151	41.7	43.1	43.1
	MS	37	10.2	10.6	53.7
	FCR	15	4.1	4.3	58.0
	Lithic	106	29.3	30.3	88.3
	S&L	41	11.3	11.7	100.0
	Total	350	96.7	100.0	
	Indeterminate	12	3.3		
Total		362	100.0		

Mapping unit types consist of MS=masonry structure, FCR=fire-cracked-rock pile, Lithic=lithic scatter, S&L=sherd and lithic scatter, and Indeterminate refers to a mapping unit findspot that was redesignated after the initial survey, thus leaving the original provenience of the projectile-point in question.

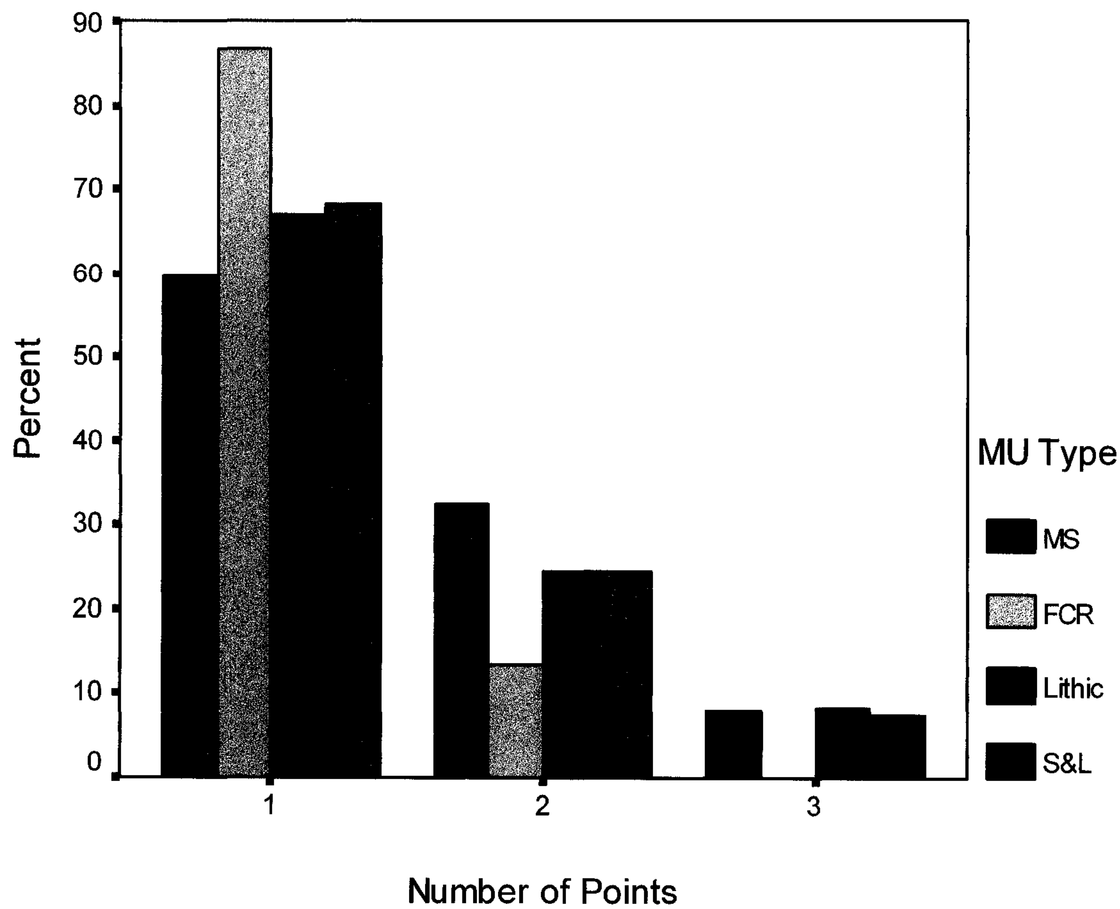


Figure 5.1: Clustered bar chart of projectile-point densities by mapping-unit type.

single mapping unit. Such low densities are in all likelihood not exclusively related to low levels of ancient hunting in the study area, but to the predisposition of the mapping unit concept to separate areas of activity rather than lump them together. This example illustrates the effect of the unit of analysis on our conceptions of what constitutes archaeological variability.

One last comment regarding the provenience frequencies of the UBARP sample is that 71% of the projectile points are recorded as isolated finds or at lithic scatters. This contributes not only to the difficulty of dating this material, but also demonstrates the significance of "non-sites" to the interpretation of the surface archaeological record (see Schiffer and Wells 1982:370).

Metric Variables

In addition to contributing to a regional analysis of projectile-point variation, analysis of metric variables (Table 5.2) assists in the interpretation of patterned differences between projectile points recorded at mapping units and along survey transects.

For example, in every case, the mean maximum measurement is greater for projectile points recorded at transects than at mapping units, while, with the exception of maximum length, projectile points recorded at mapping units have greater ranges than do those recorded at transects. In addition, T-tests (Table 5.3) show that maximum length, maximum basal width, and maximum notch width of projectile points recorded at transects are greater than those of mapping units. These patterns may be attributable to reuse and resharpening of projectile points at mapping units. Also, the higher frequency of complete points at mapping units supports the primary manufacture of projectile points

Table 5.2: Statistics of projectile-point metric variables broken down by provenience (transects and mapping units).

PROVENIENCE			max length (mm)	max width (mm)	max basal width (mm)	max basal length (mm)	max notch width (mm)
Transects	N	Valid	53	118	115	115	90
		Missing	98	33	36	36	61
	Mean		31.77	18.74	16.41	6.74	12.38
	Std. Deviation		9.22	4.62	5.00	1.88	3.10
	Range		47	27	23	8	16
	Minimum		16	7	5	3	5
	Maximum		63	34	28	11	21
Mapping Units	N	Valid	82	158	163	159	135
		Missing	129	53	48	52	76
	Mean		28.90	18.13	15.15	6.36	11.50
	Std. Deviation		7.57	5.36	4.78	2.03	3.18
	Range		33	39	35	15	21
	Minimum		15	8	3	2	3
	Maximum		48	47	38	17	24

Table 5.3: Descriptive statistics and T-test of metric variables between projectile points recorded at transects and at mapping units.

		Provenience	n	Range (mm)	Minimum (mm)	Maximum (mm)	Mean (mm)	Std. Deviation (mm)	t	df	Sig. (2-tailed)
maximum length (mm)	equal variances not assumed	Transect	53	47	16	63	31.77	9.22	**1.892**	95.596	**.061**
		Mapping Unit	82	33	15	48	28.9	7.57			
maximum width (mm)	equal variances not assumed	Transect	118	27	7	34	18.74	4.62	1.014	268.381	.312
		Mapping Unit	158	39	8	47	18.13	5.36			
maximum basal width (mm)	equal variances not assumed	Transect	115	23	5	28	16.41	5	**2.099**	238.688	**.037**
		Mapping Unit	163	35	3	38	15.15	4.78			
maximum basal length (mm)	equal variances not assumed	Transect	115	8	3	11	6.74	1.88	1.573	255.59	.117
		Mapping Unit	159	15	2	17	6.36	2.03			
maximum notch width (mm)	equal variances not assumed	Transect	90	16	5	21	12.38	3.1	**2.069**	194.047	**.040**
		Mapping Unit	135	21	3	24	11.5	3.18			

at these provenience types.

Non-metric Variables

Condition

Table 5.4 reveals some interesting differences in the condition of projectile points recorded along survey transects and at mapping units. The most significant variation occurs in the category of complete (3.0) projectile points: of 54 complete points, 37 were recorded at mapping units and 17 at transects. This lopsided finding is further reinforced by the percentages of complete projectile points found at each mapping-unit type (Fig. 5.2): masonry structures (27%), fire-cracked-rock piles (20%), and sherd and lithic scatters (17%) have higher frequencies of complete projectile points than lithic scatters (14%), and transects (11%). A provisional inference is that this pattern is attributable to spatial variation in areas of manufacture versus areas of repair and reuse, an argument that is strengthened by the frequency distributions of the metric variables[16], discussed earlier.

Another observable pattern concerns the most frequent and second most frequent condition types. For transects and mapping units, the most frequent condition is the value 2.0. But when the second most frequent condition is compared, obvious differences occur. At transects, the next most frequent condition is 2.5, a frequency that supports partial breakage from primary use; at mapping units, however, the next most frequent scale condition is 1.5, a frequency that supports areas of discard.

[16] The Frison effect, proposed by Jelinek (1976:22), states that recycled lithic artifacts become progressively reduced.

Table 5.4: Condition frequencies of projectile-points recorded at transects and at mapping units.

PROVENIENCE		Frequency	Percent	Valid Percent	Cumulative Percent
Transects	1.0	5	3.3	3.3	3.3
	1.5	28	18.5	18.5	21.9
	2.0	60	39.7	39.7	61.6
	2.5	41	27.2	27.2	88.7
	3.0	17	11.3	11.3	100.0
	Total	151	100.0	100.0	
Mapping Units	.5	2	.9	.9	.9
	1.0	6	2.8	2.8	3.8
	1.5	50	23.7	23.7	27.5
	2.0	77	36.5	36.5	64.0
	2.5	39	18.5	18.5	82.5
	3.0	37	17.5	17.5	100.0
	Total	211	100.0	100.0	

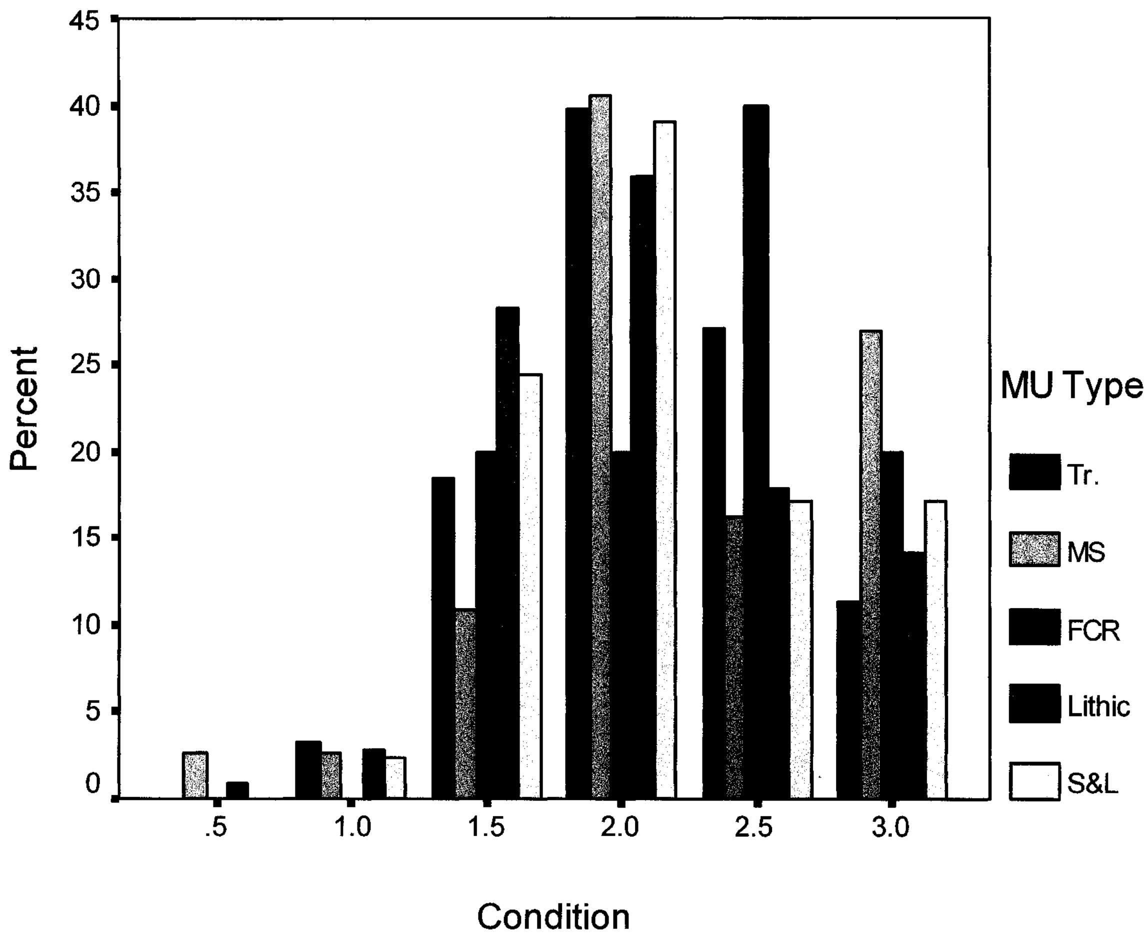


Figure 5.2: Clustered bar chart of projectile-point condition at transects and at mapping-unit types.

Material Type

Figure 5.3 indicates that chert is the dominant material type utilized for the manufacture of projectile points at both transect and mapping-unit provenience types. However, variation in material use is more apparent when mapping-unit types are independently analyzed (Fig. 5.4). In contrast to lithic scatters, all other mapping-unit types reveal considerably lower percentages of chert projectile points. Obsidian projectile points occur most frequently at fire-cracked-rock piles (50%), masonry structures (47%), and sherd and lithic scatters (39%). These patterns may be attributable to differences in the technological organization of hunting related activities at lithic scatters in contrast to multiple activities at masonry structures, fire-cracked-rock piles, and sherd and lithic scatter.

Base Type

Table 5.5 shows that the side-notched projectile point is the most common base type at both transects and mapping units. When the base-type frequencies are compared among mapping-unit types (Fig. 5.5), with the exception of fire-cracked-rock piles, the side-notched projectile point remains the preferred base type.

The minor differences in the less frequent base-type categories worth noting are the popularity of stemmed projectile-points at masonry structures (26%) and fire-cracked-rock piles (21%); and the basal-notched type at sherd and lithic scatters (23%) and along survey transects (13%). Additionally, there were no unnotched projectile points recorded at masonry structures, with the highest frequencies occurring at sherd and lithic scatters (10%), and fire-cracked-rock piles (7%).

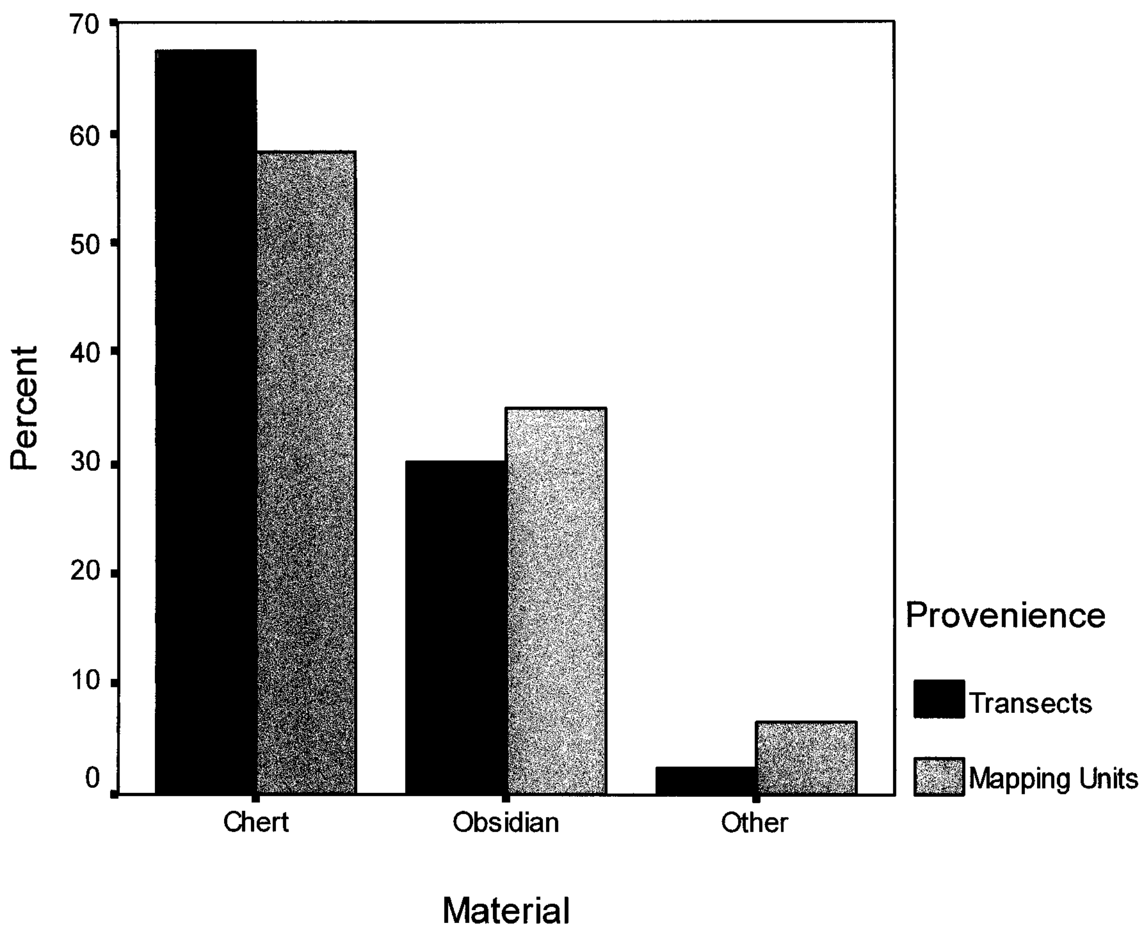


Figure 5.3: Clustered bar chart of projectile-point material types at transects and at mapping units.

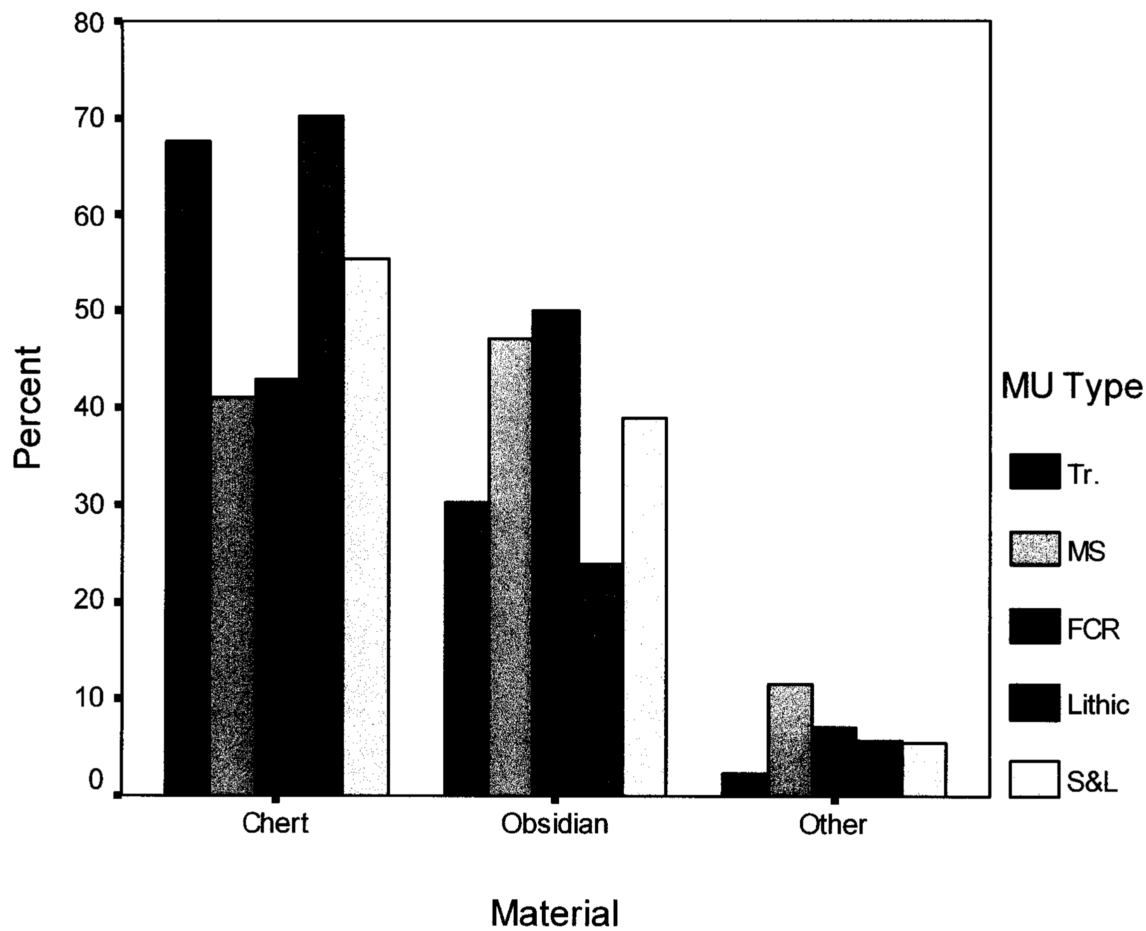


Figure 5.4: Clustered bar chart of projectile-point material types at transects and at mapping-unit types.

Table 5.5: Base type frequencies of projectile-points recorded at transects and at mapping units.

PROVENIENCE		Frequency	Percent	Valid Percent	Cumulative Percent
Transects	Side Notched	64	42.4	44.8	44.8
	Corner Notched	33	21.9	23.1	67.8
	Unnotched	4	2.6	2.8	70.6
	Stemmed	24	15.9	16.8	87.4
	Basal Notched	18	11.9	12.6	100.0
	Total	143	94.7	100.0	
	Unknown	8	5.3		
	Total	151	100.0		
Mapping Units	Side Notched	88	41.7	43.3	43.3
	Corner Notched	56	26.5	27.6	70.9
	Unnotched	8	3.8	3.9	74.9
	Stemmed	31	14.7	15.3	90.1
	Basal Notched	20	9.5	9.9	100.0
	Total	203	96.2	100.0	
	Unknown	8	3.8		
	Total	211	100.0		

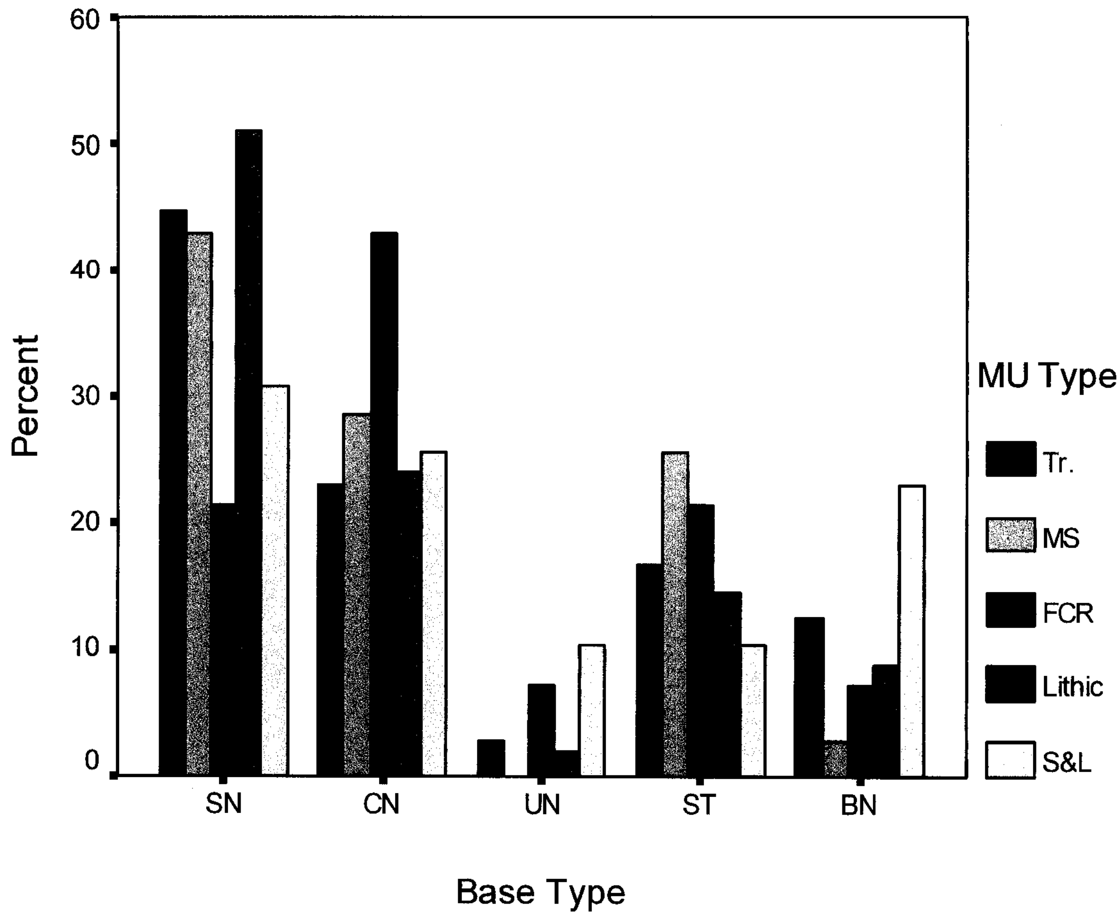


Figure 5.5: Clustered bar chart of projectile-point base types at transects and at mapping-unit types.

Chapter 6

CONCLUSIONS

This chapter discusses the inferential potential of the projectile-point data set. Initial comparisons focus on variation among mapping units with projectile points. I close with a discussion regarding the usefulness of this data set to future projectile-point studies in the Upper Basin.

Summary Statistics of Mapping Units with Projectile-Points:

1. Of 945 prehistoric mapping units, 18% contain projectile points.
2. Of 171[17] mapping units with projectile points, 19% have multiple projectile points.
3. Of 168 sherd and lithic scatters, 21% have at least one projectile point, 18% have more than one.
4. Of 439 lithic scatters, 20% have at least one projectile point, 18% have more than one.
5. Of 207 masonry structures, 14% have at least one projectile point, 24% have more than one.
6. Of 131 fire-cracked-rock piles, 11% have at least one projectile point, 7% have more than one.

Summary Statistics of Projectile-Point frequencies at Mapping Units:

1. Of 211 projectile points found at 171 mapping units, 35% are in association with other projectile points.
2. Of 54 complete projectile points, 31.5% are recorded at transects and 61.5 % are recorded at mapping units.
3. Of 37 projectile points found at masonry structures, 41% are in association with other projectile points, and 27% are complete.

[17] This total includes 7 indeterminate mapping unit types.

4. Of 15 projectile points at fire-cracked-rock piles, 13% are in association with other projectile points, and 20% are complete.

5. Of 106 projectile points at lithic scatters, 33% are in association with other projectile points, and 14% are complete.

6. Of 41 projectile points at sherd and lithic scatters, 32% are in association with other projectile points, and 17% are complete.

7. Of 151 projectile points at transects, all are isolated, and 11% are complete.

From these descriptive statistics, general statements about the sources of projectile-point variation can be constructed. Masonry structures have the highest percentages of complete and multiple projectile-points. Lithic scatters and sherd and lithic scatters have the highest percentages of projectile points and the lowest percentages of complete points. Such low frequencies of complete points rival the percentages of those recorded along transects. In contrast, fire-cracked-rock piles have the lowest abundance of projectile points, but the second highest percentage of complete projectile points.

Such variability in frequency indicates patterned differences in areas of manufacture, repair, and reuse. An inference supported by the percentages of complete and multiple projectile-points at masonry structures and fire-cracked-rock piles, which indicate areas of manufacture, repair, and reuse; as opposed to the projectile-point densities of fragmentary material at lithic scatters and sherd and lithic scatters, which indicate areas of repair.

The metric-variable descriptive frequencies support the assertion that projectile-point size is directly related to raw material type and provenience type. Local chert was abundant within the project area; consequently, chert projectile points were discarded and not reworked more readily than the higher quality obsidian from a non-local source. In most cases, obsidian projectile-points were reworked nearly to the point of exhaustion, particularly at masonry structures and fire-cracked-rock piles.

In testing whether the morphology of the projectile-points was limited by the available material types, it was determined that chert was the preferred material for the most frequent base types (side-notched, corner-notched, and stemmed projectile-point types), whereas for the manufacture of the lesser frequent point types (unnotched and basal-notched projectile-point types) obsidian was the preferred material. What appears obvious from these frequencies is the preference of obsidian over the local chert by the Upper Basin occupants during the late Ceramic and Proto-historic Periods.

Future Research

This study has succeeded in clarifying aspects of formal variation between projectile points recorded at mapping units and those recorded as isolated finds along survey transects. One profitable direction for future research is the construction of a research design whose main goal is to revisit and rerecord projectile-points within the UBARP study area. In theory, this project would not only test the stability of the archaeological landscape, but would also test the reliability of this data set and the methods of its collection.

Future analysis of the spatial distribution of projectile-points will serve as a useful indicator of land use within the project area. Ranging in age from the Archaic to the Proto-historic Periods, a more complete analysis of projectile-point densities will enhance one's ability to construct stronger arguments with regards to land use during each of these temporal periods. As such, future studies will need to generate an adequate localized projectile-point typology of the Upper Basin and surrounding Coconino Plateau.

In closing, this study has illustrated the importance of two aspects of surface archaeology. The first is the usefulness of non-site phenomena in the construction of regional models of land use. The second is how in-field analysis conserves cultural-heritage resources that archaeologists depend upon to construct models of the cultural past.

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Appendix A

Table A.1: Descriptive statistics of metric variables of the projectile-point sample.

		max length (mm)	max width (mm)	max basal width (mm)	max basal length (mm)	max notch width (mm)
N	Valid	135	276	278	274	225
	Missing	227	86	84	88	137
Mean		30.03	18.39	15.67	6.52	11.85
Std. Deviation		8.34	5.06	4.90	1.97	3.17
Range		48	40	35	15	21
Minimum		15	7	3	2	3
Maximum		63	47	38	17	24

Table A.2: Maximum length frequencies of the projectile-point sample.

	max length (mm)	Frequency	Percent	Valid Percent	Cumulative Percent
	15	2	.6	1.5	1.5
	16	2	.6	1.5	3.0
	18	1	.3	.7	3.7
	19	3	.8	2.2	5.9
	20	5	1.4	3.7	9.6
	21	7	1.9	5.2	14.8
	22	6	1.7	4.4	19.3
	23	3	.8	2.2	21.5
	24	5	1.4	3.7	25.2
	25	10	2.8	7.4	32.6
	26	6	1.7	4.4	37.0
	27	8	2.2	5.9	43.0
	28	11	3.0	8.1	51.1
	29	5	1.4	3.7	54.8
	30	6	1.7	4.4	59.3
	31	7	1.9	5.2	64.4
	32	4	1.1	3.0	67.4
	33	4	1.1	3.0	70.4
	34	2	.6	1.5	71.9
	35	8	2.2	5.9	77.8
	36	2	.6	1.5	79.3
	37	5	1.4	3.7	83.0
	38	1	.3	.7	83.7
	39	2	.6	1.5	85.2
	40	2	.6	1.5	86.7
	41	3	.8	2.2	88.9
	42	3	.8	2.2	91.1
	43	4	1.1	3.0	94.1
	45	1	.3	.7	94.8
	46	1	.3	.7	95.6
	47	1	.3	.7	96.3
	48	2	.6	1.5	97.8
	49	2	.6	1.5	99.3
	63	1	.3	.7	100.0
	Total	135	37.3	100.0	
Missing	System	227	62.7		
Total		362	100.0		

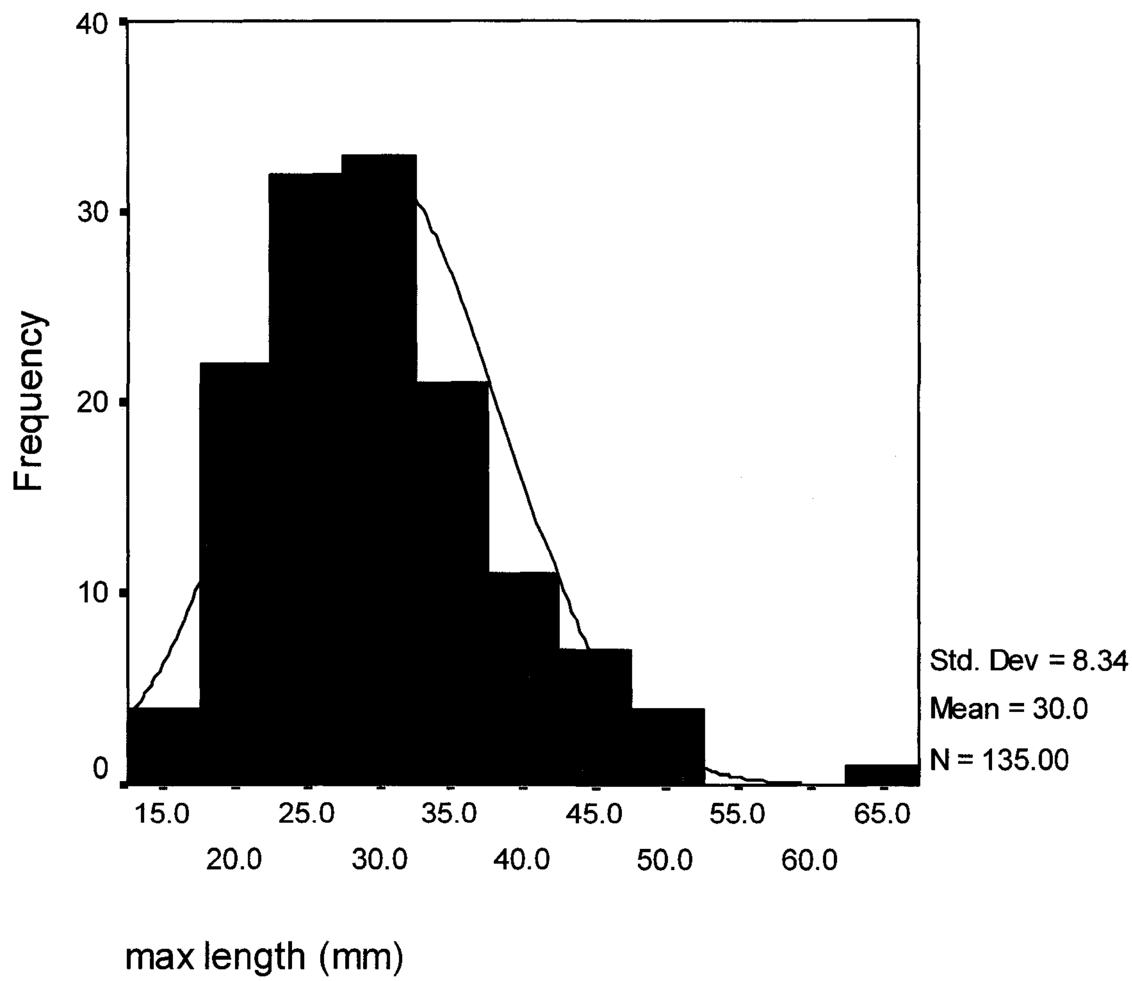


Figure A.1: Maximum length frequencies of the projectile-point sample.

Table A.3: Maximum width frequencies of the projectile-point sample.

	max width (mm)	Frequency	Percent	Valid Percent	Cumulative Percent
	7	1	.3	.4	.4
	8	5	1.4	1.8	2.2
	9	5	1.4	1.8	4.0
	10	7	1.9	2.5	6.5
	11	7	1.9	2.5	9.1
	12	8	2.2	2.9	12.0
	13	13	3.6	4.7	16.7
	14	10	2.8	3.6	20.3
	15	15	4.1	5.4	25.7
	16	16	4.4	5.8	31.5
	17	17	4.7	6.2	37.7
	18	37	10.2	13.4	51.1
	19	22	6.1	8.0	59.1
	20	34	9.4	12.3	71.4
	21	21	5.8	7.6	79.0
	22	14	3.9	5.1	84.1
	23	12	3.3	4.3	88.4
	24	6	1.7	2.2	90.6
	25	11	3.0	4.0	94.6
	26	1	.3	.4	94.9
	27	6	1.7	2.2	97.1
	28	2	.6	.7	97.8
	30	2	.6	.7	98.6
	33	1	.3	.4	98.9
	34	1	.3	.4	99.3
	35	1	.3	.4	99.6
	47	1	.3	.4	100.0
	Total	276	76.2	100.0	
Missing	System	86	23.8		
Total		362	100.0		

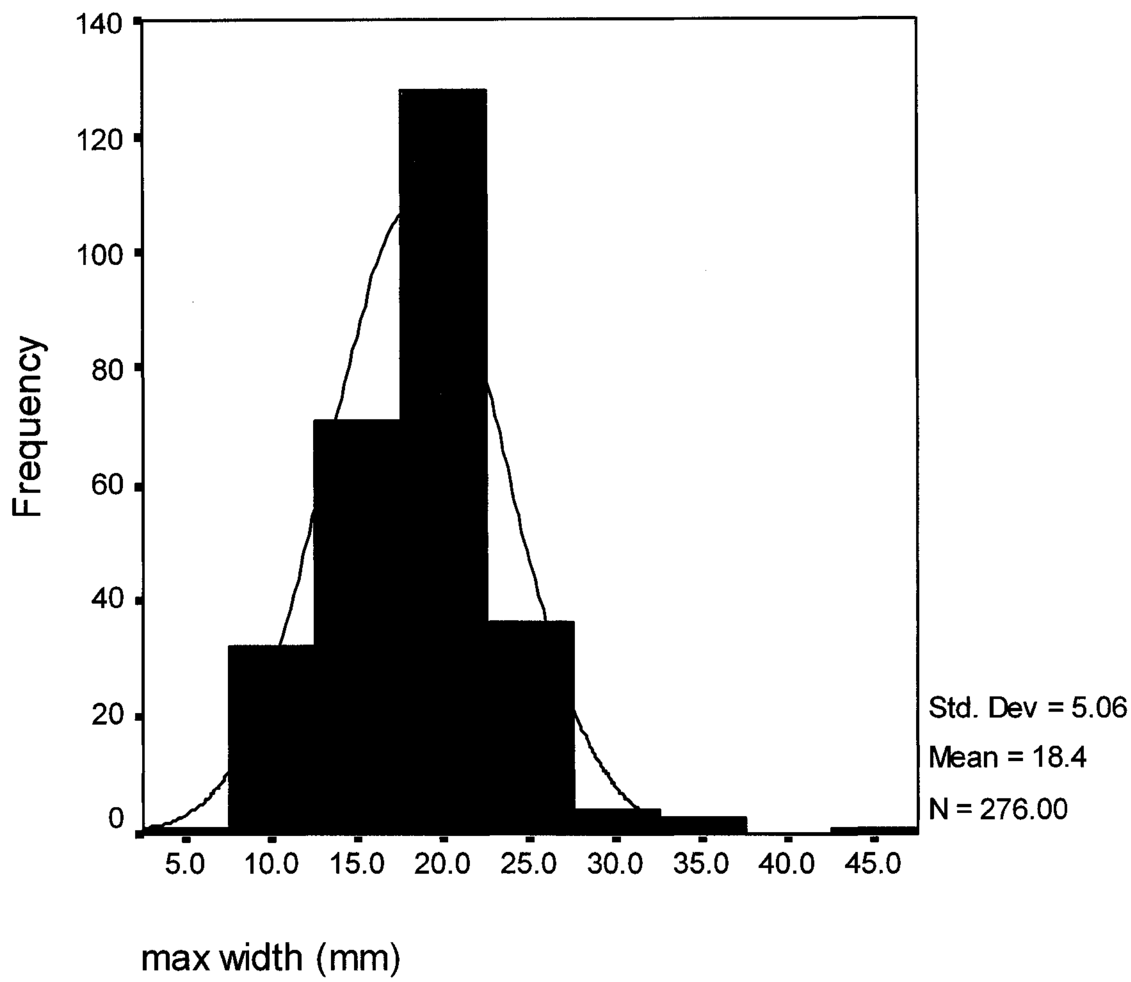


Figure A.2: Maximum width frequencies of the projectile-point sample.

Table A.4: Maximum basal width frequencies of the projectile-point sample.

	max basal width (mm)	Frequency	Percent	Valid Percent	Cumulative Percent
	3	1	.3	.4	.4
	4	2	.6	.7	1.1
	5	2	.6	.7	1.8
	6	2	.6	.7	2.5
	7	4	1.1	1.4	4.0
	8	7	1.9	2.5	6.5
	9	9	2.5	3.2	9.7
	10	13	3.6	4.7	14.4
	11	11	3.0	4.0	18.3
	12	21	5.8	7.6	25.9
	13	19	5.2	6.8	32.7
	14	22	6.1	7.9	40.6
	15	25	6.9	9.0	49.6
	16	26	7.2	9.4	59.0
	17	16	4.4	5.8	64.7
	18	26	7.2	9.4	74.1
	19	9	2.5	3.2	77.3
	20	28	7.7	10.1	87.4
	21	6	1.7	2.2	89.6
	22	7	1.9	2.5	92.1
	23	6	1.7	2.2	94.2
	24	3	.8	1.1	95.3
	25	6	1.7	2.2	97.5
	26	3	.8	1.1	98.6
	27	1	.3	.4	98.9
	28	2	.6	.7	99.6
	38	1	.3	.4	100.0
	Total	278	76.8	100.0	
Missing	System	84	23.2		
Total		362	100.0		

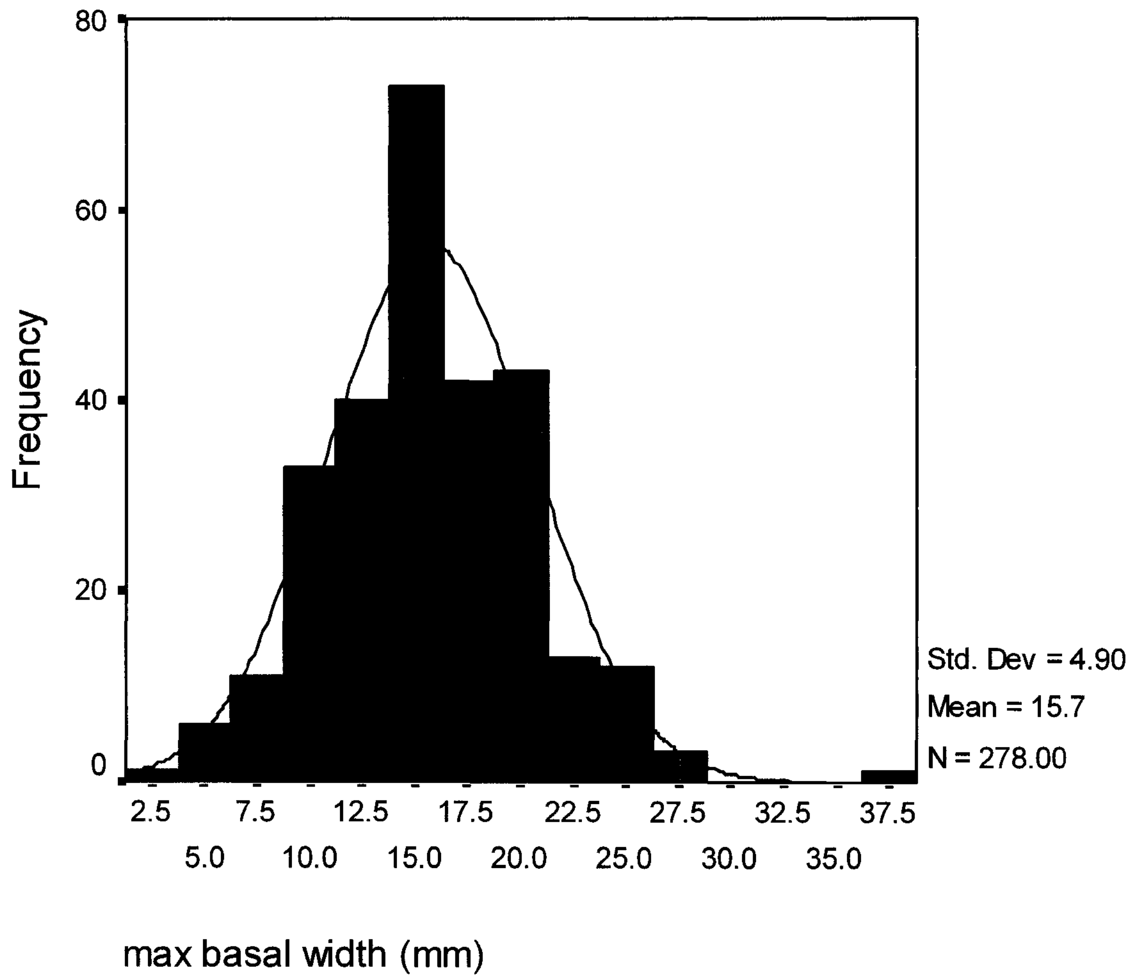


Figure A.3: Maximum basal width frequencies of the projectile-point sample.

Table A.5: Maximum basal length frequencies of the projectile-point sample.

max basal length (mm)		Frequency	Percent	Valid Percent	Cumulative Percent
	2	2	.6	.7	.7
	3	7	1.9	2.6	3.3
	4	27	7.5	9.9	13.1
	5	47	13.0	17.2	30.3
	6	68	18.8	24.8	55.1
	7	45	12.4	16.4	71.5
	8	42	11.6	15.3	86.9
	9	19	5.2	6.9	93.8
	10	9	2.5	3.3	97.1
	11	5	1.4	1.8	98.9
	13	1	.3	.4	99.3
	14	1	.3	.4	99.6
	17	1	.3	.4	100.0
	Total	274	75.7	100.0	
Missing	System	88	24.3		
Total		362	100.0		

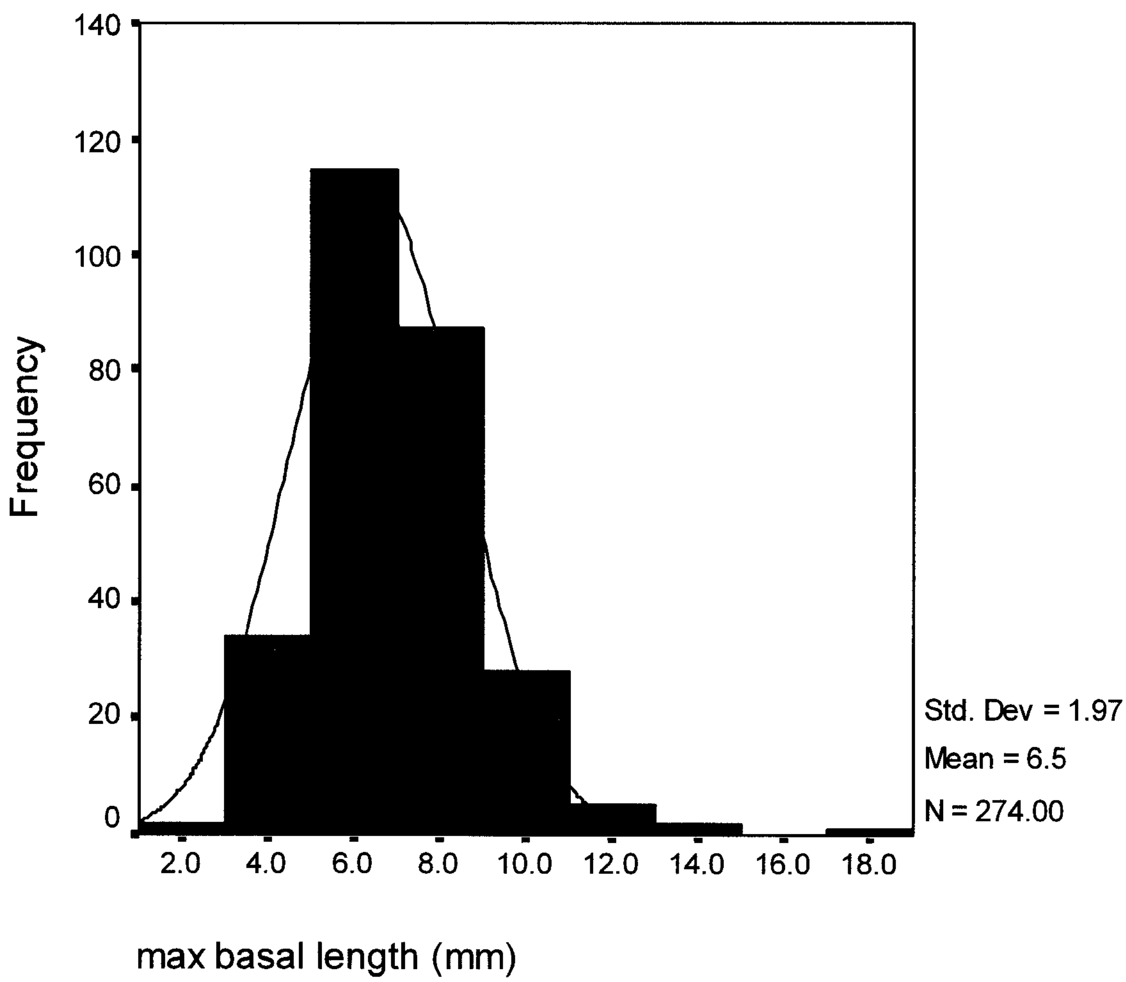


Figure A.4: Maximum basal length frequencies of the projectile-point sample.

Table A.6: Maximum notch width frequencies of the projectile-point sample.

max notch width (mm)		Frequency	Percent	Valid Percent	Cumulative Percent
	3	1	.3	.4	.4
	5	4	1.1	1.8	2.2
	6	9	2.5	4.0	6.2
	7	4	1.1	1.8	8.0
	8	12	3.3	5.3	13.3
	9	16	4.4	7.1	20.4
	10	24	6.6	10.7	31.1
	11	30	8.3	13.3	44.4
	12	36	9.9	16.0	60.4
	13	30	8.3	13.3	73.8
	14	21	5.8	9.3	83.1
	15	11	3.0	4.9	88.0
	16	10	2.8	4.4	92.4
	17	8	2.2	3.6	96.0
	18	5	1.4	2.2	98.2
	19	1	.3	.4	98.7
	20	1	.3	.4	99.1
	21	1	.3	.4	99.6
	24	1	.3	.4	100.0
	Total	225	62.2	100.0	
Missing	System	137	37.8		
Total		362	100.0		

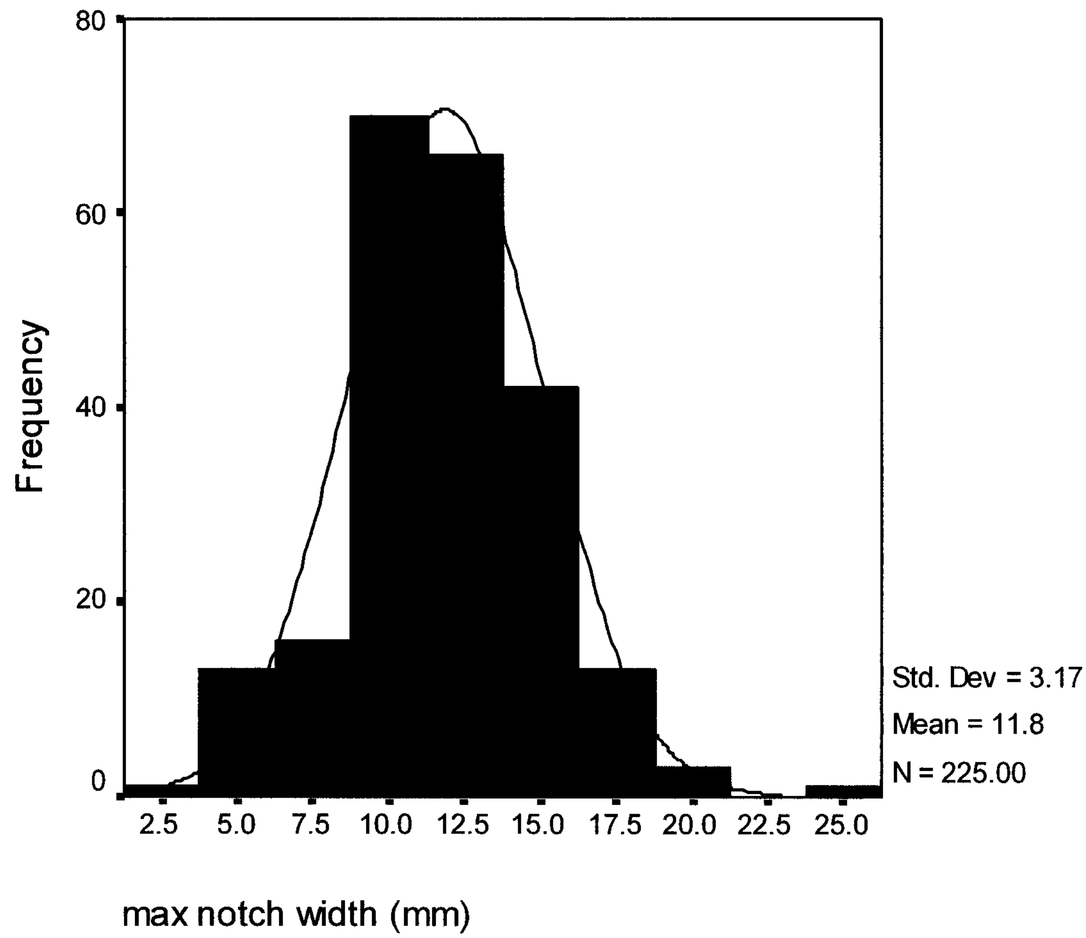


Figure A.5: Maximum notch width frequencies of the projectile-point sample.

Appendix B

Table B.1: Data set of projectile-point attributes, UBARP project 1989-2002.

Key to UBARP projectile-point database:

<u>Non-Metric Variables</u>

1. **num:** UBARP inventory number[18]
2. **date:** the date recorded; date and transect number allow for proper identification in the UBARP field notebooks
3. **trans:** the survey transect number
4. **mu:** mapping unit number, as designated in the UBARP GIS data base
5. **mutype:** designated provenience type
   .00 = Transect
   .10 = Masonry Structure
   1.00 = Fire-cracked-rock Pile
   2.00 = Lithic Scatter
   4.00 = Sherd and Lithic Scatter
   5.00 = Indeterminate Mapping-Unit Type
6. **mat:** material type
   1 = Kaibab Chert
   2 = Obsidian
   3 = Other
7. **cond:** condition
   0.5 = one partial element
   1.0 = one complete element, or two partial elements
   1.5 = one complete element and one partial element, or three partial elements
   2.0 = two complete elements, or one complete element and two partial elements
   2.5 = missing one partial element
   3.0 = complete
8. **basetype:** base type
   1 = Side-Notched
   2 = Corner-Notched
   3 = Unnotched
   4 = Stemmed
   5 = Basal-Notched

[18] The catalogue of projectile-points is organized sequentially by mapping unit number, and chronologically by UBARP inventory number for transects. Gaps in the data set are explained by projectile points that were deleted from the database because they were outside the current boundaries of the project area. These UBARP inventory numbers are 100, 101, 158, 218, and 229.

Metric Variables

1. **length:** actual length of fragmentary material
2. **maxl:** maximum length = estimated length of complete projectile point from fragmentary material
3. **widt:** actual width of fragmentary material
4. **maxwi:** maximum width = estimated width of complete projectile point from fragmentary material
5. **basalwi:** actual basal width of fragmentary material
6. **maxbw:** maximum basal width = estimated basal width of complete projectile point from fragmentary material
7. **basall:** actual basal length of fragmentary material
8. **maxbl:** maximum basal length = estimated basal length of complete projectile point from fragmentary material
9. **notchwid:** actual notch width of fragmentary material
10. **maxnw:** maximum notch width = estimated notch width of complete projectile point from fragmentary material

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
1	278	17-SEP-99	7	8.00	2.00	1	3.0	2	22	22	13	13	9	9	3	3	8	8
2	8	11-JUL-89	13	23.00	2.00	1	2.5	1	42	46	19	19	18	18	6	6	15	15
3	13	11-JUL-89	14	26.00	5.00	2	1.5	2	29	.	18	23	15	18	8	.	12	.
4	14	11-JUL-89	14	26.00	5.00	1	2.0	2	31	33	21	23	17	17	8	8	15	15
5	17	11-JUL-89	15	29.00	2.00	1	1.0	4	28	.	17	.	10	.	6	.	10	.
6	19	12-JUL-89	16	30.00	4.00	1	2.0	1	27	41	18	18	17	17	11	11	11	11
7	279	18-SEP-99	0	32.90	2.00	2	1.0	1	11	.	14	.	19	19	7	7	12	12
8	368	16-OCT-02	3	41.00	2.00	1	1.5	4	28	.	24	24	19	19	14	14	.	.
9	21	12-JUL-89	19	45.10	1.00	2	1.5	2	25	.	20	.	12	.	6	.	9	.
10	134	22-JUL-91	2	47.00	1.00	2	2.0	1	27	28	13	13	13	13	8	8	10	10
11	230	25-JUN-97	0	47.40	1.00	2	2.0	2	23	.	21	21	13	13	7	7	10	10
12	50	13-JUL-89	18	58.00	2.00	1	1.5	1	21	.	21	.	15	.	5	.	13	.
13	28	13-JUL-89	26	61.20	1.00	1	2.5	4	30	30	12	13	4	.	2	.	.	.
14	26	13-JUL-89	26	63.00	4.00	1	1.5	2	26	.	28	28	14	20	10	10	16	16
15	27	13-JUL-89	26	63.00	4.00	1	3.0	2	23	23	11	11	4	4	2	2	.	.
16	243	02-SEP-99	26	64.00	4.00	1	2.5	1	19	.	10	.	13	14	4	.	11	.
17	29	13-JUL-89	27	65.00	.10	1	3.0	2	32	35	19	19	13	13	5	5	12	12
18	242	02-SEP-99	27	65.14	4.00	2	2.0	5	23	25	8	8	11	16	9	9	8	8
19	30	13-JUL-89	27	66.10	2.00	1	.5	4	21	.	15	.	6	.	8	.	.	.
20	31	13-JUL-89	27	67.00	4.00	2	2.0	3	20	20	9	11	10	15	7	7	9	11
21	245	03-SEP-99	27	67.20	4.00	2	1.5	2	20	.	19	.	15	.	5	.	14	.
22	246	03-SEP-99	27	67.20	4.00	3	3.0	5	21	21	8	8	10	10	6	6	5	5
23	244	03-SEP-99	27	67.40	4.00	1	2.0	1	23	.	18	18	16	16	5	5	13	13
24	247	03-SEP-99	27	67.70	2.00	1	2.5	1	33	.	22	22	14	.	5	.	12	.
25	248	03-SEP-99	27	67.70	2.00	1	2.0	1	14	.	14	.	15	15	5	5	12	12
26	249	03-SEP-99	27	67.70	2.00	1	3.0	5	20	20	10	10	13	13	6	6	9	9
27	250	03-SEP-99	27	67.90	4.00	2	2.0	5	13	15	9	9	11	11	5	5	6	6
28	251	03-SEP-99	27	67.90	4.00	2	1.5	1	14	.	7	8	10	10	6	6	6	6
29	252	03-SEP-99	28	68.00	4.00	2	3.0	3	18	18	13	13	.	.	.	.	.	.
30	34	14-JUL-89	28	69.00	1.00	1	3.0	3	27	27	13	13	16	16	9	9	.	.
31	36	14-JUL-89	29	70.00	4.00	1	2.0	3	20	22	16	16	.	.	.	.	.	.
32	281	20-SEP-99	0	76.60	2.00	1	2.0	2	29	29	20	21	13	13	4	4	10	10
33	282	20-SEP-99	0	76.70	2.00	2	2.0	1	34	35	20	20	17	23	10	10	13	13
34	41	17-JUL-89	46	90.00	5.00	1	2.0	1	37	37	20	20	16	18	8	8	12	12

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
35	42	17-JUL-89	47	90.00	5.00	2	3.0	2	43	43	22	22	13	13	5	5	11	11
36	43	17-JUL-89	47	90.00	5.00	1	3.0	3	36	.	19	19	19	.	.	.	.	.
37	58	28-JUN-90	7	104.20	4.00	.	1.5	5	30	.	18	18	25	25	17	17	16	16
38	64	04-JUL-90	20	115.00	2.00	.	2.0	2	22	.	24	24	16	16	7	7	11	11
39	283	21-SEP-99	20	115.00	2.00	2	2.0	2	23	.	17	.	12	.	4	.	10	.
40	284	21-SEP-99	20	115.00	2.00	1	2.0	1	33	.	18	18	19	20	9	9	12	12
41	285	21-SEP-99	20	115.10	2.00	1	2.5	1	33	35	19	19	18	18	5	5	16	16
42	197	30-JUN-92	1	119.80	2.00	1	2.0	4	39	.	23	23	8	8	7	7	10	10
43	69	12-JUL-90	36	123.00	.10	2	3.0	4	25	25	17	17	9	10	7	7	10	10
44	196	18-JUL-92	74	127.00	.10	1	2.0	4	44	.	25	25	14	14	6	6	.	.
45	71	25-JUL-90	42	129.00	1.00	1	2.0	2	19	.	20	20	15	.	9	.	.	.
46	286	22-SEP-99	42	129.20	2.00	1	2.0	4	30	.	18	.	9	9	6	6	.	.
47	74	27-JUN-90	10	201.00	.10	1	1.5	1	29	29	23	25	22	22	8	8	18	18
48	75	27-JUN-90	1	203.00	2.00	1	2.5	1	38	40	15	15	12	12	8	8	8	8
49	76	27-JUN-90	1	204.10	2.00	2	2.0	5	22	24	16	17	17	22	6	6	15	.
50	78	27-JUN-90	9	206.00	2.00	1	2.5	2	33	36	18	18	11	11	5	5	10	.
51	79	28-JUN-90	11	207.00	.10	1	.5	1	16	.	10	.	15	.	6	.	11	.
52	80	28-JUN-90	12	208.00	.10	3	2.0	1	26	26	15	15	17	17	5	5	13	13
53	81	28-JUN-90	12	208.00	.10	2	2.5	1	27	27	15	15	15	16	5	5	13	13
54	82	28-JUN-90	13	209.00	5.00	2	1.5	1	25	.	17	.	17	.	9	.	11	.
55	86	28-JUN-90	13	210.00	2.00	1	3.0	1	24	.	19	.	13	14	5	5	11	11
56	261	07-SEP-99	23	212.10	2.00	1	2.0	1	32	.	18	18	17	17	6	6	12	12
57	263	13-SEP-99	33	215.40	2.00	1	3.0	4	26	26	8	8	3	3	2	2	.	.
58	96	03-JUL-90	35	216.00	.10	1	2.0	1	30	30	20	20	15	17	5	5	15	15
59	97	03-JUL-90	35	216.00	.10	1	2.0	2	27	.	16	.	13	.	3	.	12	.
60	102	04-JUL-90	44	222.00	5.00	2	1.5	1	22	.	18	.	13	.	3	.	10	.
61	259	06-SEP-99	48	227.00	4.00	2	2.0	2	26	.	17	17	9	9	4	4	9	9
62	110	06-JUL-90	60	232.00	.10	.	2.0	4	41	.	20	20	15	15	8	8	.	.
63	231	24-JUN-97	60	232.10	1.00	3	3.0	2	33	33	18	19	14	15	7	7	11	11
64	112	06-JUL-90	63	234.00	2.00	1	2.0	4	36	.	20	20	10	12	5	5	.	.
65	114	12-JUL-90	66	235.00	5.00	2	2.0	1	21	.	23	23	20	20	6	6	14	14
66	115	12-JUL-90	66	235.00	5.00	2	1.0	1	19	19	10	10	13	14	7	7	10	10
67	116	12-JUL-90	66	235.00	5.00	2	2.0	.	18	.	.	.	15	.	.	.	.	.
68	117	12-JUL-90	67	236.00	1.00	2	2.5	5	25	25	8	8	11	11	8	8	7	7

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
69	304	24-OCT-00	1	253.00	2.00	3	2.5	5	42	.	15	15	18	18	.	.	.	.
70	305	24-OCT-00	2	259.00	2.00	1	2.0	2	18	.	20	20	16	16	6	6	11	11
71	307	25-OCT-00	1	270.00	2.00	2	2.5	1	19	20	17	.	11	.	6	.	13	.
72	308	25-OCT-00	2	276.00	.10	2	3.0	4	30	30	20	20	11	11	4	4	13	.
73	309	25-OCT-00	3	282.00	2.00	1	1.5	2	22	.	21	.	10	.	6	.	10	.
74	125	28-JUN-90	10	303.00	2.00	1	1.5	1	28	.	21	21	20	20	8	8	12	12
75	126	29-JUN-90	11	305.00	2.00	1	1.5	1	34	.	22	22	22	24	5	5	17	17
76	256	06-SEP-99	11	306.10	1.00	.	1.5	2	15	.	13	20	21	21	8	8	14	14
77	258	06-SEP-99	11	306.50	4.00	1	2.0	4	21	.	17	17	10	10	4	4	9	9
78	253	04-SEP-99	21	313.00	4.00	1	2.0	1	24	.	14	14	14	14	6	6	9	9
79	257	06-SEP-99	21	313.11	1.00	1	2.5	4	23	23	11	11	4	.	3	.	.	.
80	254	04-SEP-99	21	313.40	4.00	1	2.5	2	45	47	21	21	12	14	5	5	11	11
81	255	04-SEP-99	21	313.40	4.00	2	3.0	5	21	21	11	11	13	13	6	6	8	8
82	127	03-JUL-90	24	314.00	1.00	2	2.5	1	24	.	17	17	16	16	7	7	13	13
83	262	09-SEP-99	30	318.00	5.00	2	2.0	2	22	.	18	.	14	14	5	5	12	12
84	130	05-JUL-90	36	320.00	5.00	1	2.5	2	41	.	18	18	12	12	6	6	9	9
85	289	24-SEP-99	57	331.00	1.00	1	3.0	1	22	22	13	14	6	11	5	5	6	.
86	287	23-SEP-99	0	350.20	2.00	1	3.0	1	34	34	19	19	17	17	6	6	12	12
87	288	23-SEP-99	0	350.20	2.00	1	1.5	1	28	.	20	22	18	18	8	8	12	12
88	290	24-SEP-99	0	356.00	2.00	1	1.5	1	31	.	20	20	18	18	6	6	17	17
89	300	18-OCT-00	4	502.00	.10	1	3.0	1	27	27	16	16	17	17	6	6	13	13
90	163	25-JUL-91	19	503.00	4.00	1	2.5	4	24	24	14	17	5	.	5	5	.	.
91	310	26-OCT-00	1	552.10	2.00	1	1.5	1	15	.	17	.	17	20	7	7	13	13
92	311	26-OCT-00	2	557.00	2.00	1	2.5	5	32	.	18	18	19	19	7	7	13	13
93	312	26-OCT-00	3	559.00	2.00	2	3.0	3	28	.	19	19	18	.	.	.	.	.
94	313	26-OCT-00	3	559.00	2.00	1	2.0	1	25	.	19	20	18	18	8	8	13	13
95	314	30-OCT-00	1	571.00	2.00	1	3.0	2	40	40	19	20	14	14	6	6	13	13
96	315	30-OCT-00	1	573.00	4.00	1	1.5	2	32	32	17	35	12	23	5	5	9	20
97	316	30-OCT-00	1	573.00	4.00	1	1.5	2	26	.	46	47	38	38	13	13	24	24
98	332	30-OCT-01	0	583.00	2.00	2	3.0	1	24	24	18	18	18	18	6	6	12	12
99	317	01-NOV-00	3	589.00	4.00	2	2.5	5	17	.	15	15	16	16	7	7	13	13
100	240	02-SEP-99	0	600.00	2.00	3	2.5	1	26	.	13	13	13	13	9	9	10	10
101	140	23-JUL-91	2	604.00	4.00	.	2.0	4	24	24	12	16	5	5	6	6	.	.
102	142	23-JUL-91	3	604.10	4.00	.	2.5	4	29	29	19	19	.	.	4	.	.	.

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
103	138	23-JUL-91	1	605.00	2.00	2	1.5	.	16	.	.	.	16	.	11	.	17	.
104	232	30-JUN-97	1	605.00	2.00	1	3.0	4	37	37	19	19	8	8	5	5	.	.
105	143	23-JUL-91	3	607.00	4.00	.	1.0	1	26	.	16	.	15	18	6	.	11	11
106	149	24-JUL-91	5	610.00	2.00	1	1.5	1	31	.	17	.	14	14	9	9	11	11
107	150	24-JUL-91	5	610.00	2.00	2	1.5	5	23	.	14	.	14	.	5	.	14	.
108	152	24-JUL-91	8	612.00	2.00	2	2.0	2	22	.	15	15	10	.	3	.	10	.
109	160	25-JUL-91	15	616.00	.10	2	2.0	1	31	.	20	20	14	15	7	7	11	11
110	206	09-JUL-92	8	658.00	2.00	2	1.5	.	.	.	13	.	10	.	3	.	10	.
111	203	08-JUL-92	6	662.00	2.00	2	2.5	4	27	30	22	22	9	.	5	5	.	.
112	164	06-JUL-92	9	706.00	.10	3	2.0	4	31	33	17	18	13	14	7	7	.	.
113	265	15-SEP-99	13	711.00	4.00	1	2.0	5	35	.	11	11	10	10	3	.	.	.
114	165	07-JUL-92	14	712.00	2.00	1	2.0	2	25	.	18	18	13	14	4	4	10	10
115	264	15-SEP-99	14	713.00	2.00	1	2.0	2	19	.	20	20	15	15	5	.	13	.
116	167	08-JUL-92	17	715.00	2.00	2	2.5	4	23	.	15	.	10	.	6	.	.	.
117	168	08-JUL-92	17	715.00	2.00	2	3.0	5	32	32	15	15	10	10	8	8	9	9
118	260	07-SEP-99	27	720.10	4.00	1	2.5	1	32	32	16	16	14	14	4	4	12	12
119	266	15-SEP-99	31	723.40	2.00	1	1.5	1	21	.	28	30	17	17	5	5	14	14
120	267	15-SEP-99	31	723.50	2.00	2	2.0	4	21	.	19	.	8	.	3	.	.	.
121	170	10-JUL-92	40	725.00	2.00	1	1.5	1	20	.	16	.	17	17	5	5	13	13
122	175	13-JUL-92	48	729.10	.10	2	2.5	5	15	15	15	15	4	.	1	.	6	6
123	176	13-JUL-92	48	729.20	.10	.	2.0	1	42	.	17	17	14	14	7	7	10	10
124	177	14-JUL-92	51	730.00	4.00	1	1.5	2	30	.	17	17	10	12	6	6	8	8
125	178	14-JUL-92	54	731.00	4.00	3	3.0	1	24	24	17	17	10	10	5	5	11	11
126	180	14-JUL-92	55	732.10	.10	2	3.0	1	27	27	19	19	18	18	5	5	14	14
127	181	14-JUL-92	55	732.10	.10	2	2.0	1	17	28	18	.	16	16	4	4	13	13
128	179	14-JUL-92	55	733.00	.10	2	3.0	1	28	28	14	14	15	15	6	6	11	11
129	182	14-JUL-92	60	735.10	.10	3	1.5	.	.	.	20	.	11	.	5	.	.	.
130	183	14-JUL-92	60	735.20	.10	2	2.0	1	21	.	15	.	13	13	6	6	9	9
131	365	14-OCT-02	0	738.01	.10	1	2.0	2	19	.	18	18	13	13	5	5	10	10
132	184	15-JUL-92	65	739.00	2.00	1	3.0	1	42	42	18	18	14	14	7	7	10	10
133	234	19-JUN-97	65	739.00	2.00	2	2.0	1	22	.	12	.	14	.	5	5	12	12
134	185	16-JUL-92	65	740.00	.10	3	2.0	2	26	.	27	28	21	21	8	8	16	16
135	186	16-JUL-92	65	740.00	.10	2	1.5	2	16	.	19	27	19	21	10	10	14	14
136	187	16-JUL-92	67	742.00	2.00	1	1.0	1	18	.	17	23	18	20	8	8	14	.

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
137	235	19-JUN-97	67	742.00	2.00	1	1.5	1	18	.	19	.	15	.	4	.	13	.
138	188	16-JUL-92	67	743.00	4.00	2	1.5	5	18	.	18	.	19	19	5	5	12	12
139	189	16-JUL-92	67	743.00	4.00	1	2.0	2	17	.	19	.	15	15	8	8	12	12
140	236	19-JUN-97	67	743.00	4.00	1	2.0	1	46	48	18	18	16	16	5	5	13	13
141	190	16-JUL-92	67	746.00	2.00	3	2.5	2	31	.	20	22	10	10	4	4	.	.
142	191	16-JUL-92	68	747.00	.10	1	2.5	2	33	.	9	9	9	9	4	4	6	6
143	192	16-JUL-92	68	747.00	.10	2	3.0	2	19	19	10	10	7	7	4	4	5	5
144	193	16-JUL-92	68	748.00	.10	2	2.0	4	21	.	15	15	9	9	6	6	.	.
145	233	18-JUN-97	69	749.00	2.00	1	2.0	1	32	.	25	.	15	.	6	6	14	14
146	194	17-JUL-92	72	752.00	2.00	1	2.0	1	13	.	18	.	16	16	7	7	12	12
147	195	17-JUL-92	73	753.00	2.00	1	3.0	2	31	31	18	18	10	10	4	4	9	9
148	214	09-JUL-93	3	912.00	.10	1	2.5	.	32	.	17	.	14	.	4	.	.	.
149	215	09-JUL-93	3	912.00	.10	2	2.5	1	27	.	18	.	18	.	7	.	15	.
150	268	15-SEP-99	1	913.00	1.00	1	2.5	4	22	22	10	12	6	6	4	4	.	.
151	216	09-JUL-93	6	914.10	4.00	2	1.5	.	25	.	20	.	7	.	2	.	10	.
152	217	10-JUL-93	4	916.00	2.00	1	2.0	1	20	.	11	11	10	10	5	5	9	9
153	270	15-SEP-99	1	917.00	4.00	2	3.0	1	22	22	12	14	11	11	4	4	9	9
154	280	18-SEP-99	1	918.03	2.00	1	3.0	2	28	28	19	19	15	15	6	6	12	12
155	276	15-SEP-99	1	919.00	2.00	.	1.5	1	27	.	21	.	14	.	9	.	13	13
156	220	14-JUL-93	1	931.00	2.00	3	2.5	1	24	.	20	20	23	23	5	5	19	19
157	291	27-SEP-99	0	932.00	2.00	1	2.0	1	21	.	18	.	18	18	8	8	12	12
158	292	27-SEP-99	0	936.00	2.00	1	1.5	2	34	.	19	20	15	16	6	6	14	.
159	293	27-SEP-99	0	939.00	2.00	1	2.0	2	19	.	19	19	15	15	5	5	10	10
160	294	28-SEP-99	0	946.00	2.00	1	2.0	1	33	.	19	20	15	15	7	7	10	10
161	295	28-SEP-99	0	952.00	4.00	1	3.0	3	38	38	13	13	7	.	.	.	.	.
162	296	29-SEP-99	0	979.00	.10	1	1.0	2	23	.	20	22	11	16	6	6	10	10
163	297	30-SEP-99	0	998.00	2.00	2	1.5	1	19	.	19	.	19	20	6	6	13	13
164	298	30-SEP-99	0	998.00	2.00	1	2.5	5	21	21	9	9	10	11	6	6	6	6
165	223	30-AUG-94	1	1000.00	2.00	3	2.0	3	21	.	24	25	21	.	.	.	.	.
166	237	02-JUL-97	1	1000.00	2.00	1	1.5	5	18	.	21	21	18	18	7	.	16	.
167	238	02-JUL-97	8	1006.10	2.00	1	1.5	2	14	.	22	22	16	16	6	6	11	.
168	239	02-JUL-97	8	1006.10	2.00	1	2.5	4	38	41	16	16	12	12	8	8	10	10
169	333	27-SEP-02	1	1010.00	.10	2	2.0	4	30	.	25	25	16	26	7	7	.	.
170	354	10-OCT-02	1	1010.00	.10	1	2.0	2	27	.	17	18	12	12	6	6	10	10

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
171	355	10-OCT-02	1	1010.00	.10	2	3.0	1	26	26	12	12	8	8	3	3	8	8
172	334	27-SEP-02	2	1011.00	2.00	1	1.5	4	35	35	32	.	14	.	10	.	.	.
173	224	07-SEP-94	11	1012.00	2.00	1	1.5	1	30	.	21	21	17	18	9	9	14	14
174	335	30-SEP-02	1	1014.00	4.00	2	2.0	.	22	.	17	.	12	.	5	.	.	.
175	356	10-OCT-02	3	1018.00	.10	1	1.5	1	31	.	25	27	14	20	6	6	13	13
176	336	01-OCT-02	5	1022.00	2.00	.	2.0	1	22	.	17	17	16	18	9	9	12	12
177	337	03-OCT-02	1	1032.00	4.00	.	2.5	2	35	.	21	23	14	14	5	5	.	.
178	338	03-OCT-02	4	1038.00	2.00	2	2.0	2	25	.	27	27	19	19	9	9	14	14
179	339	04-OCT-02	3	1047.00	2.00	.	2.0	5	25	25	10	10	12	12	6	6	5	5
180	341	05-OCT-02	2	1056.00	2.00	1	2.5	2	35	35	24	27	15	19	7	7	11	11
181	342	05-OCT-02	6	1058.00	2.00	.	2.5	1	31	.	21	21	20	20	8	8	12	12
182	343	05-OCT-02	6	1060.00	2.00	1	2.0	2	27	.	23	.	16	16	6	6	15	15
183	345	08-OCT-02	2	1068.00	4.00	1	1.5	5	19	.	21	24	23	23	7	7	14	14
184	346	08-OCT-02	2	1072.00	2.00	2	2.0	1	20	.	16	.	16	16	6	6	12	12
185	347	08-OCT-02	3	1074.00	2.00	2	2.0	2	14	.	14	14	8	8	6	6	8	8
186	348	08-OCT-02	3	1074.00	2.00	1	1.5	1	21	.	16	16	18	20	10	10	12	12
187	349	08-OCT-02	5	1080.00	4.00	1	2.0	1	25	25	18	.	15	17	4	.	13	.
188	350	09-OCT-02	2	1086.00	2.00	1	2.0	2	17	.	14	14	10	11	7	7	6	6
189	351	09-OCT-02	2	1086.00	2.00	3	2.0	1	25	25	18	18	17	.	3	3	14	14
190	352	09-OCT-02	2	1087.00	2.00	1	3.0	2	30	30	21	21	17	17	7	7	13	13
191	318	12-OCT-01	0	1109.00	2.00	1	1.5	1	24	.	23	25	23	25	8	8	18	18
192	319	12-OCT-01	0	1110.00	2.00	1	1.5	1	21	.	26	.	21	.	8	.	14	14
193	320	16-OCT-01	5	1112.00	2.00	1	1.5	1	17	.	21	21	16	20	8	8	11	11
194	324	19-OCT-01	0	1140.00	2.00	2	2.0	1	15	.	10	10	8	8	4	4	6	6
195	325	19-OCT-01	0	1145.00	2.00	1	2.0	1	17	.	20	20	15	15	6	6	13	13
196	326	19-OCT-01	0	1145.00	2.00	1	2.5	2	32	32	18	18	8	14	6	6	11	11
197	327	19-OCT-01	0	1147.00	2.00	1	2.0	1	21	.	16	.	16	.	7	.	14	.
198	329	30-OCT-01	0	1178.00	2.00	1	1.5	4	30	.	23	23	13	.	7	.	13	.
199	330	30-OCT-01	0	1181.00	2.00	2	2.5	1	21	21	13	13	16	16	6	6	12	12
200	331	30-OCT-01	0	1183.00	2.00	1	2.0	1	23	26	20	20	18	27	8	8	15	17
201	358	11-OCT-02	1	1202.00	.10	1	2.5	4	38	39	17	18	12	12	8	8	.	.
202	359	11-OCT-02	1	1207.00	4.00	2	2.0	1	22	.	18	18	13	15	7	7	12	12
203	361	11-OCT-02	4	1215.00	1.00	2	2.5	2	40	42	21	21	14	15	7	7	12	12
204	362	11-OCT-02	4	1215.00	1.00	2	1.5	.	15	.	16	.	14	14	9	.	11	.

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
205	364	14-OCT-02	3	1220.00	2.00	2	3.0	1	28	28	15	16	15	15	7	7	8	8
206	369	18-OCT-02	1	1224.00	.10	.	3.0	4	20	20	15	15	11	11	4	4	.	.
207	10	11-JUL-89	0	1227.00	2.00	1	1.5	1	29	.	19	.	13	15	6	6	11	12
208	11	11-JUL-89	0	1227.00	2.00	1	1.5	1	23	.	16	16	12	16	5	.	9	.
209	12	11-JUL-89	0	1227.00	2.00	1	2.0	4	27	.	16	.	10	.	6	6	.	.
210	370	21-OCT-02	3	1243.00	.10	2	3.0	2	21	21	12	13	3	4	3	3	3	3
211	371	23-OCT-02	1	1252.00	2.00	2	1.5	2	18	.	17	20	10	10	5	5	8	8
212	1	10-JUL-89	1	.00	.00	2	1.5	1	24	.	20	.	12	.	8	.	16	.
213	2	10-JUL-89	1	.00	.00	1	2.0	1	21	25	19	19	19	19	5	5	14	14
214	3	10-JUL-89	3	.00	.00	1	2.5	5	23	27	18	18	15	17	9	9	15	15
215	4	10-JUL-89	6	.00	.00	1	2.5	5	25	.	19	19	10	.	1	.	11	.
216	5	10-JUL-89	7	.00	.00	2	2.5	1	29	.	13	13	12	12	5	5	11	11
217	6	11-JUL-89	7	.00	.00	1	1.5	2	37	.	18	18	7	7	4	4	.	.
218	7	11-JUL-89	8	.00	.00	.	1.5	2	31	.	18	.	8	.	7	.	11	.
219	9	11-JUL-89	13	.00	.00	3	1.5	1	31	.	27	.	19	.	8	.	16	.
220	15	11-JUL-89	15	.00	.00	1	2.5	5	29	29	18	18	22	22	11	11	18	18
221	16	11-JUL-89	15	.00	.00	1	2.0	1	21	.	9	.	7	.	4	.	6	.
222	18	12-JUL-89	15	.00	.00	1	2.0	1	36	45	25	25	17	20	7	7	16	.
223	20	12-JUL-89	17	.00	.00	2	1.5	5	32	.	17	17	.	.	.	.	.	.
224	22	12-JUL-89	22	.00	.00	2	2.5	5	25	25	21	21	18	18	9	9	16	16
225	23	13-JUL-89	23	.00	.00	1	1.5	5	14	16	10	10	15	20	6	6	10	10
226	24	13-JUL-89	24	.00	.00	1	3.0	2	49	49	20	20	15	15	5	5	11	11
227	25	13-JUL-89	25	.00	.00	1	2.0	1	29	.	30	30	28	28	11	11	14	14
228	32	14-JUL-89	27	.00	.00	2	2.0	1	21	.	9	9	8	12	6	6	6	.
229	33	14-JUL-89	27	.00	.00	1	2.0	1	32	.	16	16	20	20	8	8	13	13
230	37	17-JUL-89	31	.00	.00	1	2.0	4	32	.	19	19	8	8	6	6	.	.
231	38	17-JUL-89	32	.00	.00	1	2.0	4	24	.	15	.	7	.	3	.	.	.
232	39	17-JUL-89	39	.00	.00	2	3.0	3	33	.	12	12	10	.	.	.	.	.
233	40	17-JUL-89	39	.00	.00	2	3.0	2	43	43	25	25	18	20	8	8	16	16
234	44	10-JUL-89	3	.00	.00	1	1.5	5	28	.	18	20	20	20	7	7	14	14
235	45	10-JUL-89	4	.00	.00	1	1.5	1	39	.	22	.	20	20	8	8	16	16
236	46	11-JUL-89	6	.00	.00	2	1.5	2	.	.	23	.	16	.	11	.	12	12
237	47	11-JUL-89	6	.00	.00	1	2.0	2	45	.	23	23	16	16	8	8	11	11
238	48	12-JUL-89	15	.00	.00	.	2.5	3	36	37	17	18	.	.	.	.	.	.

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
239	49	12-JUL-89	16	.00	.00	2	2.0	1	18	.	21	21	22	22	8	8	11	11
240	51	14-JUL-89	32	.00	.00	1	2.0	5	20	.	15	15	17	17	7	7	12	12
241	52	14-JUL-89	44	.00	.00	1	2.0	1	38	41	20	20	18	20	8	8	17	17
242	53	18-JUL-89	53	.00	.00	1	2.0	3	35	.	19	.	19	.	.	.	.	.
243	54	19-JUL-89	58	.00	.00	2	1.5	1	24	.	17	17	6	.	4	.	12	.
244	55	19-JUL-89	58	.00	.00	2	2.5	5	29	29	11	11	13	13	9	9	7	7
245	56	19-JUL-89	60	.00	.00	3	1.5	1	26	.	21	21	22	25	8	8	11	11
246	57	19-JUL-89	61	.00	.00	2	1.0	.	12	.	.	.	23	23	7	.	15	.
247	59	29-JUN-90	10	.00	.00	1	2.0	1	27	.	20	20	18	18	8	8	11	11
248	60	02-JUL-90	13	.00	.00	2	2.0	5	34	34	18	20	17	20	6	6	18	18
249	61	02-JUL-90	13	.00	.00	1	3.0	4	20	20	12	12	7	.	2	.	.	.
250	62	02-JUL-90	14	.00	.00	1	2.5	1	42	42	24	24	19	20	9	9	16	16
251	63	02-JUL-90	15	.00	.00	1	2.0	2	38	.	34	34	26	26	10	10	21	21
252	65	06-JUL-90	31	.00	.00	1	2.0	5	31	31	16	16	16	16	5	5	14	14
253	66	06-JUL-90	31	.00	.00	2	2.0	4	30	.	21	.	12	.	7	.	.	.
254	67	06-JUL-90	32	.00	.00	2	2.0	1	31	.	19	19	16	16	6	6	13	13
255	68	06-JUL-90	33	.00	.00	1	2.0	1	31	.	26	26	25	25	8	8	14	14
256	70	25-JUL-90	38	.00	.00	1	1.5	1	27	.	22	25	18	20	9	9	16	.
257	72	27-JUN-90	2	.00	.00	1	1.5	2	28	.	20	20	8	.	4	.	10	.
258	73	27-JUN-90	3	.00	.00	2	2.5	1	33	33	14	16	12	12	6	6	9	9
259	77	27-JUN-90	8	.00	.00	1	2.5	4	31	31	15	15	8	.	3	.	8	.
260	83	28-JUN-90	13	.00	.00	2	1.0	.	21	.	12	.	8	.	6	.	.	.
261	84	28-JUN-90	13	.00	.00	1	3.0	3	27	27	13	14	.	.	.	.	.	.
262	85	28-JUN-90	13	.00	.00	1	1.5	2	28	.	23	23	15	15	7	7	10	10
263	87	28-JUN-90	15	.00	.00	.	1.0	1	12	.	.	.	18	18	9	9	14	.
264	88	28-JUN-90	15	.00	.00	.	2.5	2	31	35	19	19	14	14	4	4	9	9
265	89	28-JUN-90	16	.00	.00	.	2.5	4	22	.	13	13	9	9	7	7	.	.
266	90	28-JUN-90	19	.00	.00	1	1.5	5	26	.	19	.	19	.	.	.	.	.
267	91	29-JUN-90	20	.00	.00	1	2.0	2	19	.	22	22	13	13	5	5	10	10
268	92	29-JUN-90	21	.00	.00	1	3.0	1	28	28	15	15	12	15	5	5	11	11
269	93	29-JUN-90	23	.00	.00	1	2.0	1	23	.	10	10	10	10	3	3	9	9
270	94	29-JUN-90	29	.00	.00	1	1.5	1	25	.	17	17	12	13	6	6	10	10
271	95	29-JUN-90	32	.00	.00	.	2.0	1	30	30	19	.	15	.	6	.	16	.
272	98	03-JUL-90	36	.00	.00	.	1.5	1	19	.	15	.	12	.	6	.	10	.

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
273	99	04-JUL-90	40	.00	.00	1	3.0	1	35	35	21	21	17	17	6	6	13	13
274	103	04-JUL-90	45	.00	.00	.	2.5	5	42	43	14	14	13	18	9	9	15	15
275	104	04-JUL-90	45	.00	.00	1	2.0	4	32	.	23	23	15	15	11	11	.	.
276	105	05-JUL-90	47	.00	.00	.	2.5	.	36	37	20	.	11	.	3	.	.	.
277	106	05-JUL-90	49	.00	.00	3	2.5	4	26	28	18	18	7	7	4	4	.	.
278	107	05-JUL-90	49	.00	.00	.	2.5	.	26	.	17	17	10	.	3	.	10	.
279	108	05-JUL-90	50	.00	.00	.	1.5	1	29	.	15	16	10	15	10	10	7	.
280	109	05-JUL-90	51	.00	.00	.	2.5	.	47	.	23	23	14	.	4	.	.	.
281	111	06-JUL-90	61	.00	.00	2	2.0	4	21	.	15	.	9	.	4	.	8	.
282	113	12-JUL-90	65	.00	.00	1	2.5	1	35	.	21	21	18	18	8	8	13	13
283	118	25-JUL-90	72	.00	.00	1	2.5	2	29	.	27	27	23	23	7	7	16	16
284	119	25-JUL-90	72	.00	.00	1	1.5	1	25	.	8	.	11	.	8	.	6	.
285	120	25-JUL-90	73	.00	.00	1	2.0	2	29	.	21	21	14	16	5	5	13	13
286	121	25-JUL-90	75	.00	.00	1	2.0	4	26	28	14	14	5	5	3	3	.	.
287	122	25-JUL-90	75	.00	.00	1	2.0	1	15	.	18	18	15	15	6	6	11	11
288	123	28-JUN-90	7	.00	.00	1	2.0	1	43	43	18	18	10	20	8	8	13	13
289	124	28-JUN-90	9	.00	.00	1	2.0	4	26	.	21	21	11	13	6	6	13	13
290	128	04-JUL-90	25	.00	.00	2	1.0	.	11	.	.	.	24	24	9	.	12	.
291	129	05-JUL-90	31	.00	.00	1	1.5	1	15	.	12	.	20	20	8	8	11	11
292	131	06-JUL-90	41	.00	.00	1	1.5	2	36	.	20	20	18	20	7	7	18	.
293	132	06-JUL-90	44	.00	.00	1	2.0	1	24	26	18	18	14	16	4	4	13	.
294	133	06-JUL-90	45	.00	.00	1	2.0	2	31	.	26	.	21	21	9	9	15	15
295	135	23-JUL-91	1	.00	.00	.	1.5	4	28	.	25	.	10	.	7	7	.	.
296	136	23-JUL-91	1	.00	.00	.	1.5	2	27	.	35	.	20	20	10	10	16	.
297	137	23-JUL-91	1	.00	.00	.	1.5	1	26	.	21	21	25	25	8	8	15	15
298	139	23-JUL-91	2	.00	.00	.	1.5	.	20	.	17	.	12	12	9	.	.	.
299	141	23-JUL-91	2	.00	.00	2	2.5	1	27	.	16	16	.	.	8	8	14	.
300	144	23-JUL-91	4	.00	.00	.	2.5	1	25	25	16	20	12	13	5	5	12	12
301	145	23-JUL-91	4	.00	.00	.	2.5	4	28	28	18	18	9	9	6	6	.	.
302	146	23-JUL-91	4	.00	.00	.	3.0	1	24	.	16	.	13	13	5	5	11	11
303	147	23-JUL-91	5	.00	.00	1	2.5	5	16	16	9	9	8	9	4	4	7	7
304	148	24-JUL-91	5	.00	.00	2	2.0	4	26	26	18	18	12	12	6	6	.	.
305	151	24-JUL-91	5	.00	.00	1	2.0	2	30	.	19	.	15	15	8	8	12	12
306	153	24-JUL-91	10	.00	.00	2	2.0	1	30	.	24	.	18	.	8	.	21	.

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
307	154	24-JUL-91	10	.00	.00	1	2.0	1	30	31	20	20	12	17	6	6	12	12
308	155	24-JUL-91	11	.00	.00	2	3.0	1	21	21	13	13	13	15	6	6	11	11
309	156	24-JUL-91	11	.00	.00	2	1.0	1	17	.	18	22	18	21	6	6	15	15
310	157	24-JUL-91	12	.00	.00	2	2.5	1	22	22	19	20	16	16	6	6	14	14
311	159	24-JUL-91	14	.00	.00	2	2.5	1	21	21	15	15	12	14	3	3	13	13
312	161	25-JUL-91	17	.00	.00	1	2.0	2	18	.	20	.	7	.	8	.	.	.
313	162	25-JUL-91	18	.00	.00	1	2.5	1	31	31	22	22	17	18	5	5	15	15
314	166	08-JUL-92	17	.00	.00	1	2.0	1	36	.	23	23	22	22	10	10	17	17
315	169	08-JUL-92	21	.00	.00	1	2.5	1	28	.	19	.	.	.	8	.	.	.
316	171	13-JUL-92	44	.00	.00	2	2.0	4	26	.	17	17	8	8	6	6	9	9
317	172	13-JUL-92	46	.00	.00	1	2.0	1	39	.	17	17	12	18	8	8	10	10
318	173	13-JUL-92	48	.00	.00	1	2.5	2	35	35	18	18	12	12	7	7	9	9
319	174	13-JUL-92	48	.00	.00	1	2.0	2	25	.	25	25	17	17	8	8	12	12
320	198	30-JUN-92	1	.00	.00	2	2.0	5	14	.	12	12	16	16	7	7	11	11
321	199	30-JUN-92	2	.00	.00	2	2.0	1	25	27	20	22	17	28	8	8	15	.
322	200	08-JUL-92	2	.00	.00	1	1.5	2	18	.	23	25	19	19	5	5	17	17
323	201	08-JUL-92	5	.00	.00	2	2.0	4	23	.	12	12	6	6	4	4	.	.
324	202	08-JUL-92	5	.00	.00	1	3.0	4	26	.	17	.	7	.	6	.	.	.
325	204	08-JUL-92	6	.00	.00	1	2.0	2	24	.	17	19	12	12	4	4	10	10
326	205	08-JUL-92	7	.00	.00	2	2.0	5	26	.	21	21	22	22	11	11	18	18
327	207	09-JUL-92	9	.00	.00	2	3.0	5	20	.	16	16	16	.	4	.	15	.
328	208	09-JUL-92	11	.00	.00	2	2.5	1	31	31	18	18	16	16	7	7	14	14
329	209	05-JUL-93	3	.00	.00	1	2.0	4	27	.	17	.	11	11	6	6	.	.
330	211	07-JUL-93	8	.00	.00	1	2.0	1	35	.	19	19	18	18	8	8	8	8
331	212	07-JUL-93	11	.00	.00	1	3.0	4	39	39	20	20	10	10	4	4	.	.
332	213	08-JUL-93	1	.00	.00	2	2.5	4	28	28	18	18	8	.	5	5	10	.
333	219	13-JUL-93	3	.00	.00	1	2.0	1	33	.	13	13	14	14	5	5	9	9
334	221	19-JUL-93	8	.00	.00	1	3.0	1	28	28	20	20	25	25	7	7	17	17
335	222	19-JUL-93	10	.00	.00	1	2.0	4	40	.	21	21	12	13	4	4	12	12
336	225	09-SEP-94	14	.00	.00	2	2.5	2	21	25	14	17	12	12	6	6	10	10
337	226	14-SEP-94	20	.00	.00	1	3.0	1	48	48	22	22	18	18	9	9	14	14
338	227	14-SEP-94	21	.00	.00	.	2.0	2	41	.	24	24	15	26	7	7	12	12
339	228	22-SEP-94	0	.00	.00	2	2.5	2	33	37	12	12	7	7	4	4	6	6
340	241	02-SEP-99	27	.00	.00	1	3.0	5	19	19	7	7	12	12	6	6	6	6

	num	date	trans	mu	mutype	mat	cond	basetype	length	maxl	widt	maxwi	basalwi	maxbw	basall	maxbl	notchwid	maxnw
341	271	15-SEP-99	1	.00	.00	1	2.0	1	29	.	16	16	14	14	4	4	11	11
342	272	15-SEP-99	1	.00	.00	1	2.0	2	35	.	22	22	7	13	7	7	9	.
343	273	15-SEP-99	2	.00	.00	1	2.0	2	24	.	16	18	12	12	7	7	8	8
344	274	15-SEP-99	2	.00	.00	1	1.5	2	11	.	17	18	12	13	7	7	10	10
345	275	15-SEP-99	2	.00	.00	1	3.0	2	36	36	12	12	9	9	4	4	7	7
346	277	16-SEP-99	0	.00	.00	1	2.5	4	49	49	19	19	11	11	5	5	.	.
347	299	18-OCT-00	2	.00	.00	2	2.5	1	27	27	21	21	16	20	6	6	14	14
348	301	19-OCT-00	2	.00	.00	1	2.5	1	44	.	24	24	21	21	7	7	17	17
349	302	19-OCT-00	5	.00	.00	1	3.0	4	46	.	18	18	12	12	6	6	5	5
350	303	20-OCT-00	1	.00	.00	2	2.5	1	22	.	14	14	15	.	5	.	13	.
351	306	25-OCT-00	1	.00	.00	1	2.5	1	31	31	18	20	17	20	6	6	11	.
352	321	16-OCT-01	4	.00	.00	.	2.5	1	22	23	16	16	17	18	7	7	14	14
353	323	18-OCT-01	2	.00	.00	1	2.0	2	28	.	22	25	22	24	9	9	16	16
354	328	26-OCT-01	0	.00	.00	2	2.0	.	30	.	15	.	15	.	12	.	14	.
355	340	05-OCT-02	2	.00	.00	1	2.0	2	35	.	19	19	15	15	8	8	13	13
356	344	07-OCT-02	4	.00	.00	.	2.0	4	25	.	19	19	17	22	6	6	11	11
357	353	09-OCT-02	4	.00	.00	1	1.5	1	29	.	24	27	15	18	10	10	12	12
358	357	11-OCT-02	1	.00	.00	1	2.0	1	25	.	17	.	13	14	6	6	12	12
359	360	11-OCT-02	3	.00	.00	1	2.5	1	39	.	20	20	19	20	6	6	13	13
360	363	14-OCT-02	3	.00	.00	1	2.0	1	24	.	17	18	12	12	6	6	8	8
361	366	15-OCT-02	3	.00	.00	1	2.5	2	32	.	15	15	12	12	7	7	13	13
362	367	16-OCT-02	1	.00	.00	1	2.5	2	62	63	31	33	19	19	9	9	15	15

Figure B.1: Projectile-point illustrations, UBARP project 1989-2002, drawings are to scale.

<u>**Key Attributes of each figure**</u>:

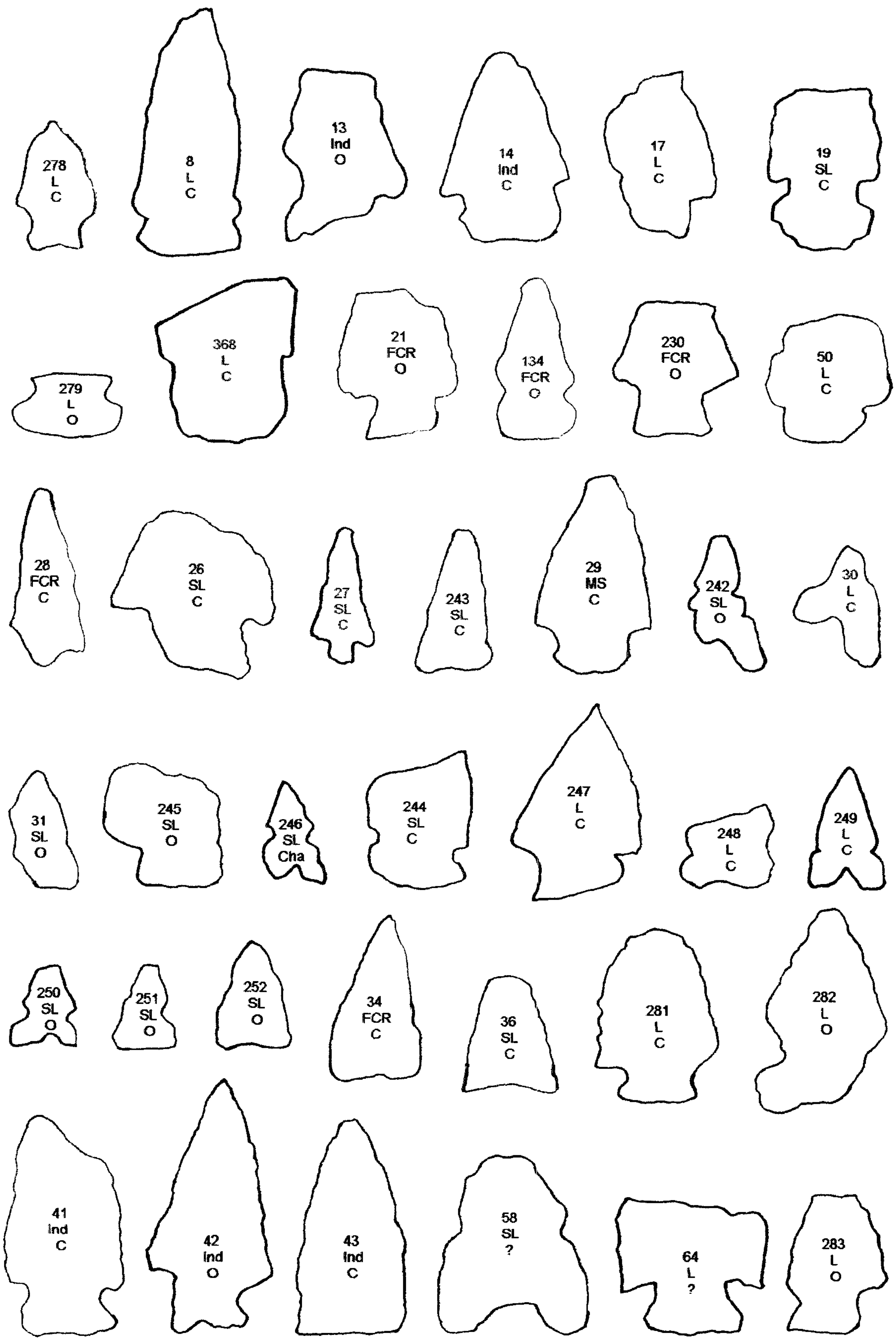
1. **UBARP inventory number:** this number designates the order in which the projectile points were recorded by the survey crew.

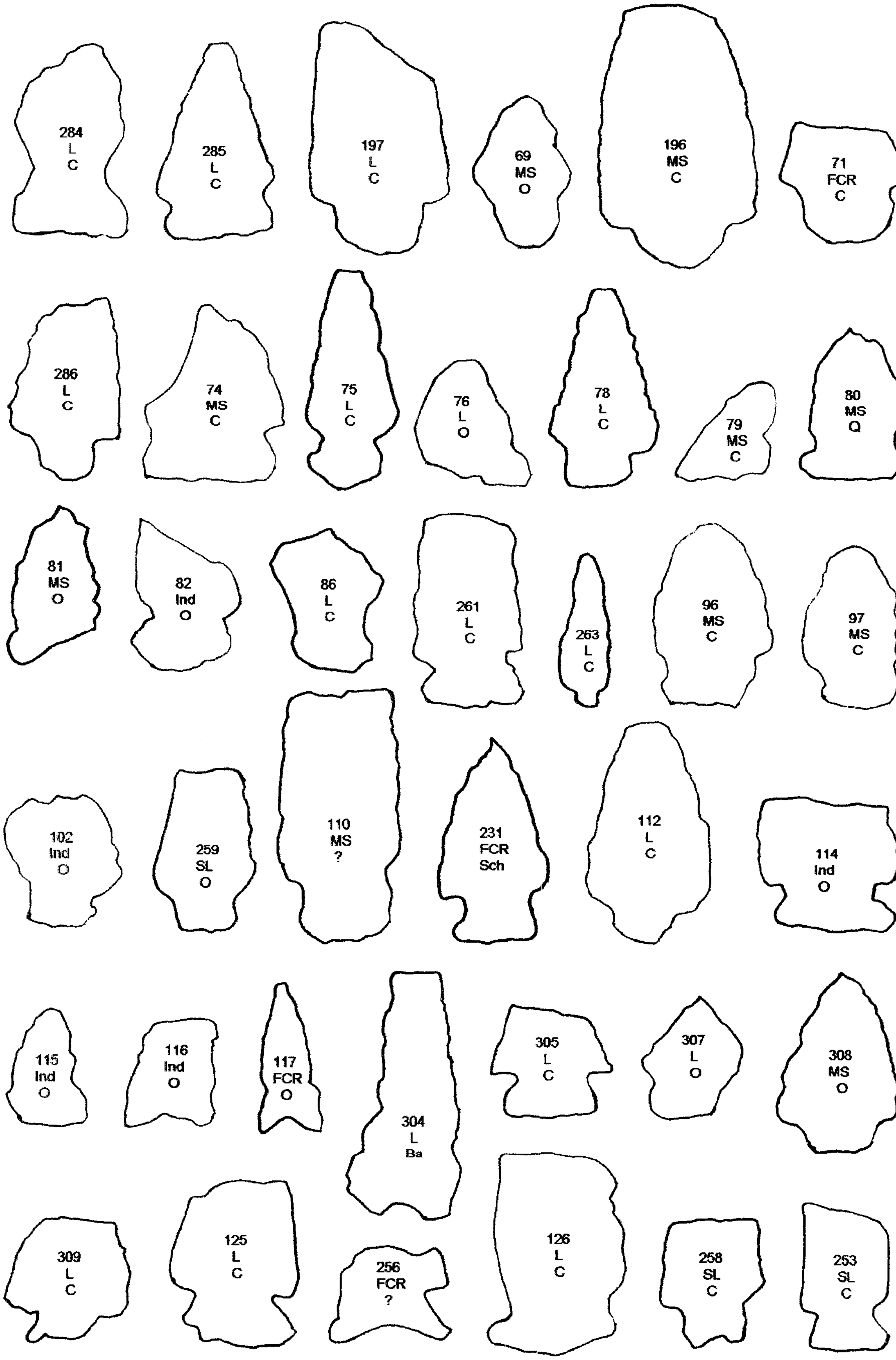
2. **Provenience**: the abbreviations designate the provenience of each figure.

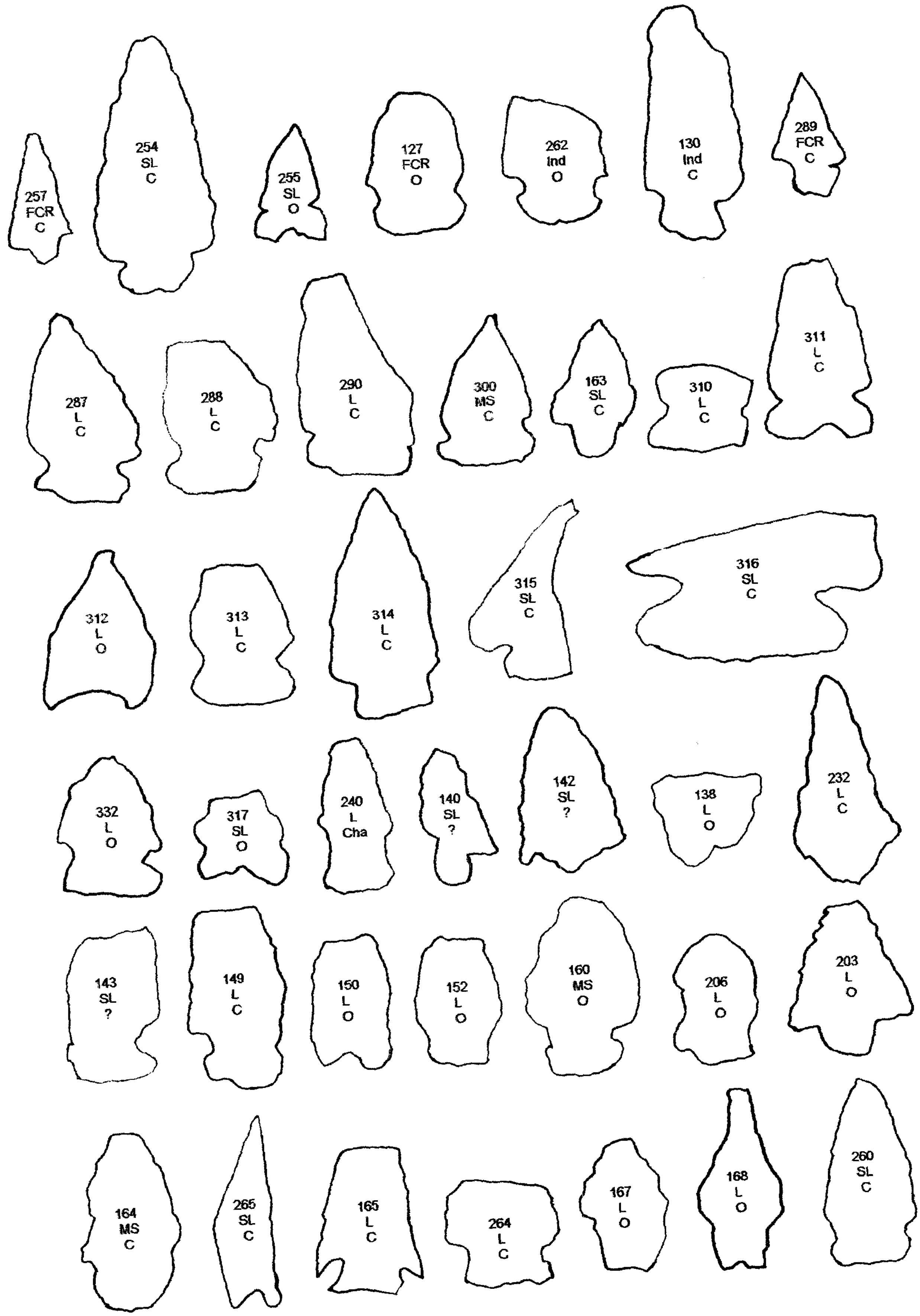
    a. Tr = Transect
    b. MS = Masonry Structure
    c. FCR = Fire-cracked-rock Pile
    d. L = Lithic Scatter
    e. SL = Sherd and Lithic Scatter
    f. Ind = Indeterminate (mapping unit)

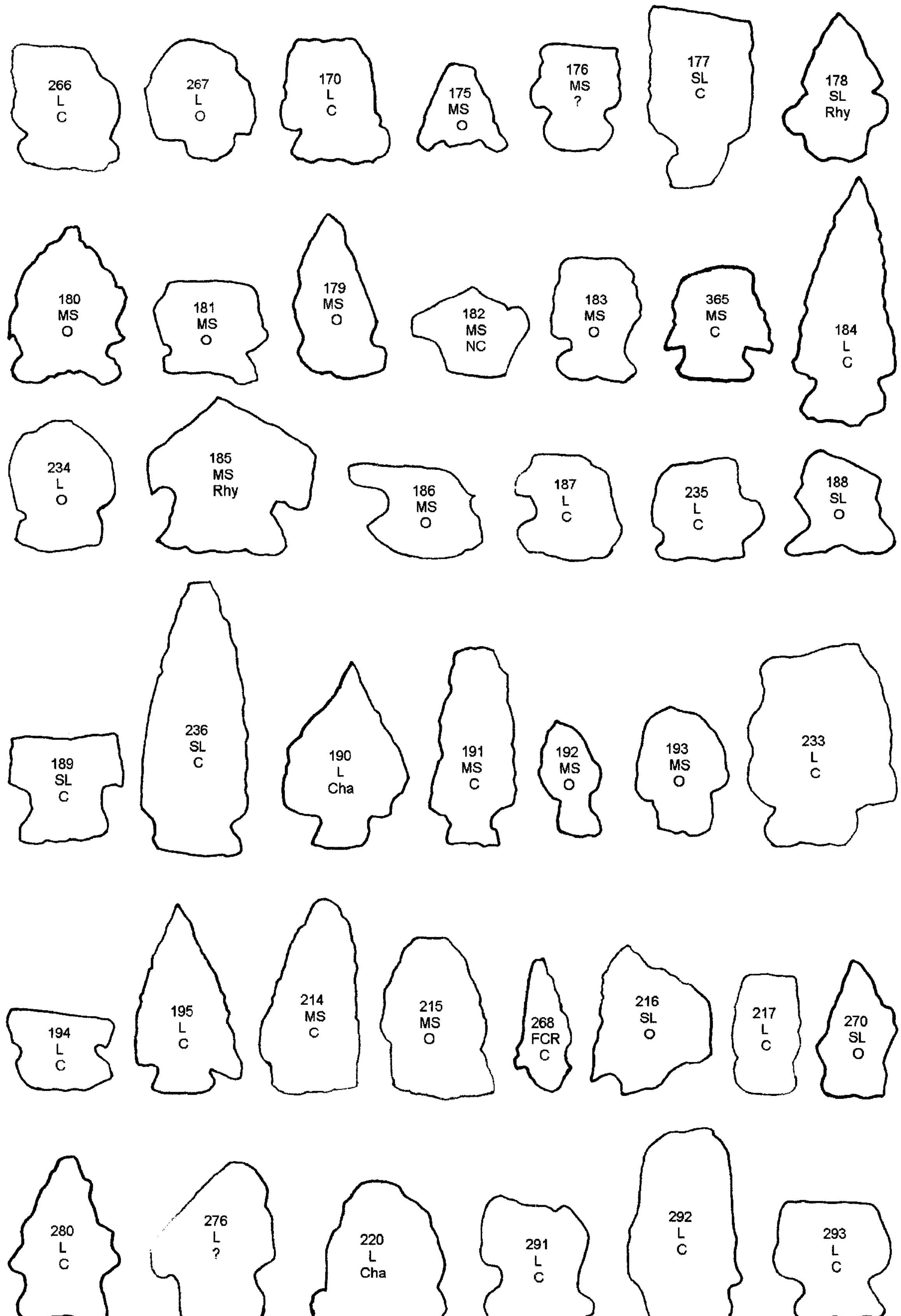
3. **Material Type**: the abbreviations designate the material type of each figure.

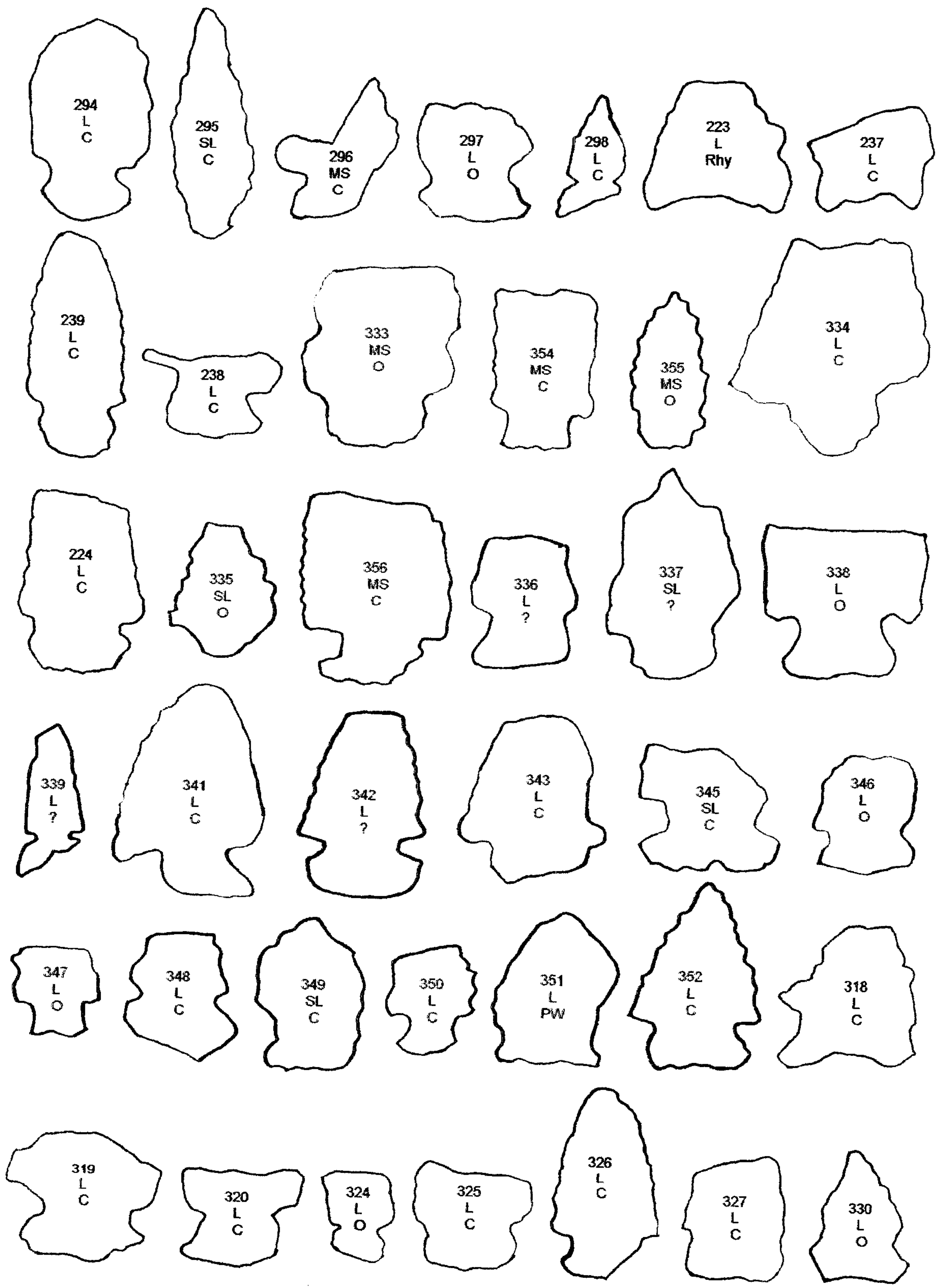
    a. C = Kaibab Chert
    b. O = Obsidian
    c. Cha = Chalcedony
    d. Rhy = Rhyolite
    e. Q = Quartzite
    f. NC = Non-local Chert
    g. Ba = Basalt
    h. Sch = Schist
    i. PW = Petrified Wood

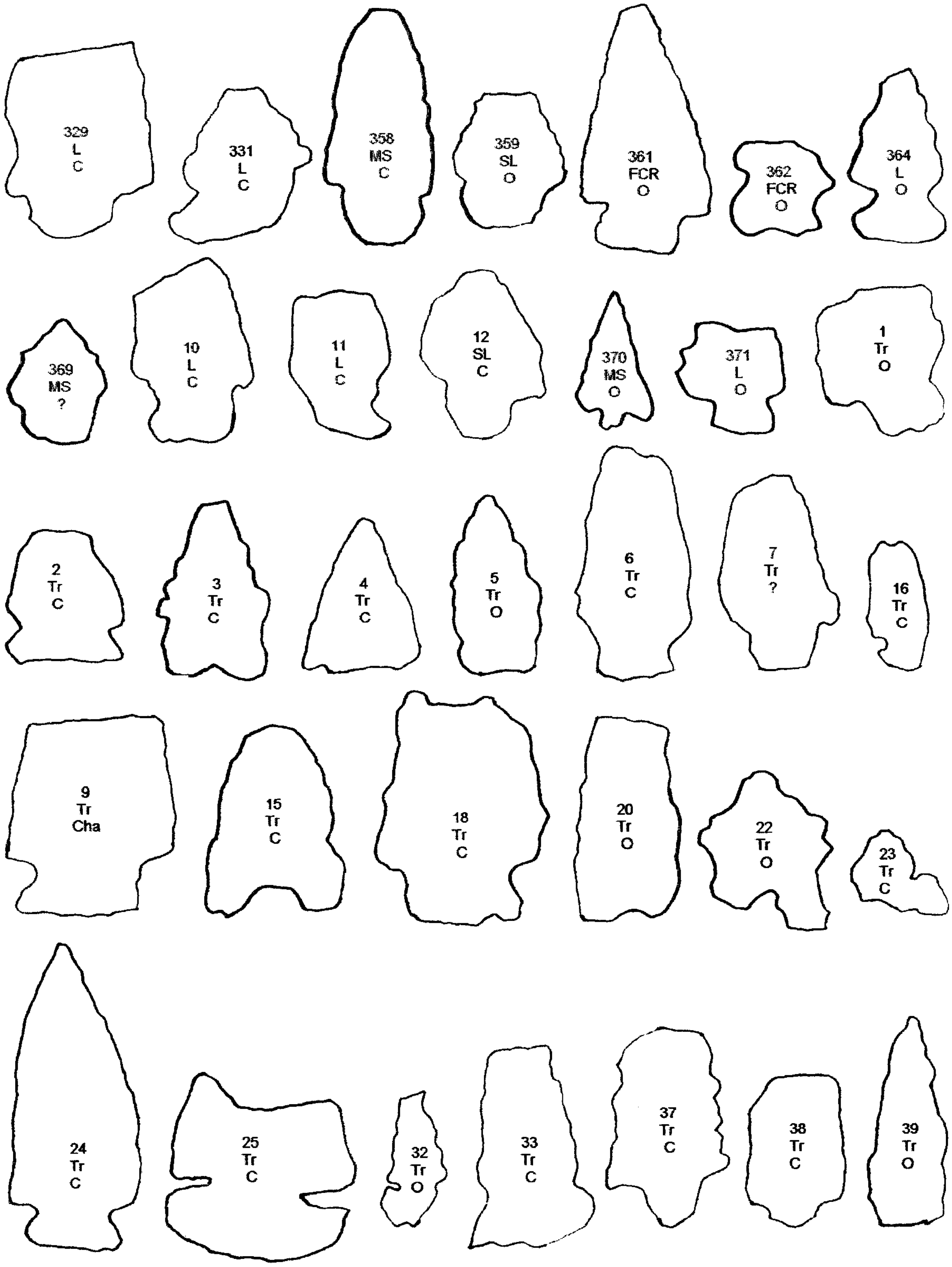

278 L C
8 L C
13 Ind O
14 Ind C
17 L C
19 SL C
279 L O
368 L C
21 FCR O
134 FCR O
230 FCR O
50 L C
28 FCR C
26 SL C
27 SL C
243 SL C
29 MS C
242 SL O
30 L C
31 SL O
245 SL O
246 SL Cha
244 SL C
247 L C
248 L C
249 L C
250 SL O
251 SL O
252 SL O
34 FCR C
36 SL C
281 L C
282 L O
41 Ind C
42 Ind O
43 Ind C
58 SL ?
64 L ?
283 L O

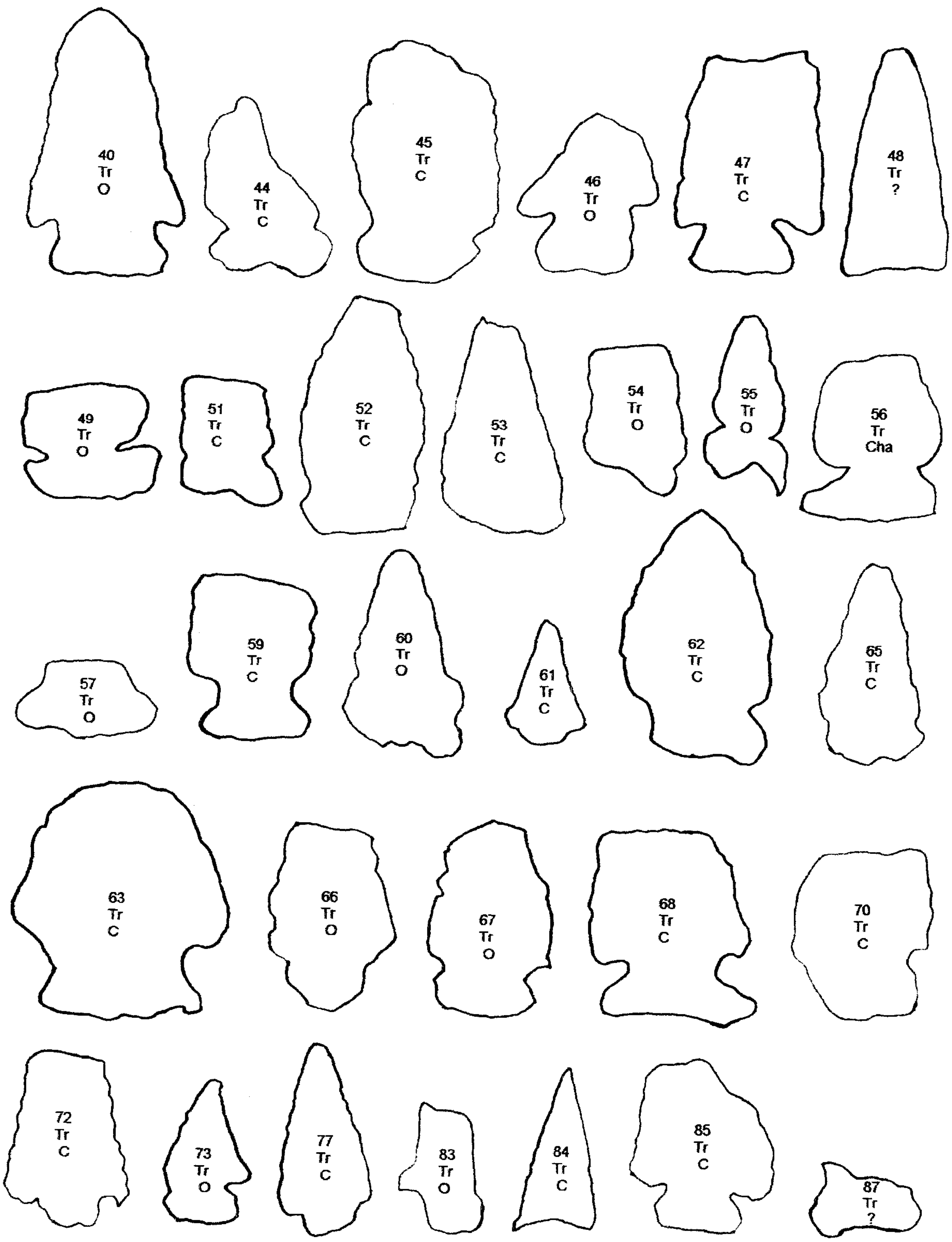

284 L C
285 L C
197 L C
69 MS O
196 MS C
71 FCR C
286 L C
74 MS C
75 L C
76 L O
78 L C
79 MS C
80 MS Q
81 MS O
82 Ind O
86 L C
261 L C
263 L C
96 MS C
97 MS C
102 Ind O
259 SL O
110 MS ?
231 FCR Sch
112 L C
114 Ind O
115 Ind O
116 Ind O
117 FCR O
304 L Ba
305 L C
307 L O
308 MS O
309 L C
125 L C
256 FCR ?
126 L C
258 SL C
253 SL C

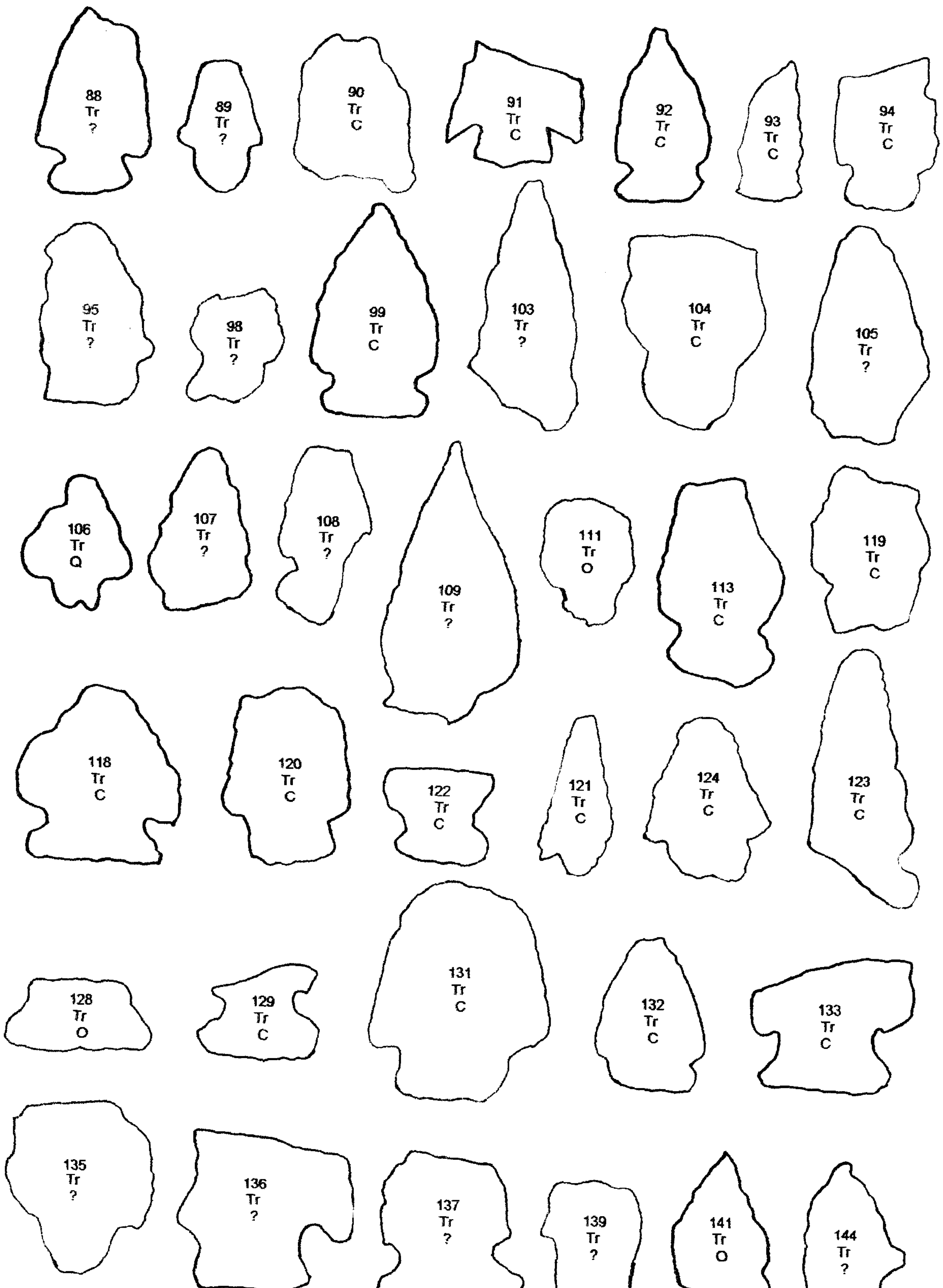

257 FCR C
254 SL C
255 SL O
127 FCR O
262 Ind O
130 Ind C
289 FCR C
287 L C
288 L C
290 L C
300 MS C
163 SL C
310 L C
311 L C
312 L O
313 L C
314 L C
315 SL C
316 SL C
332 L O
317 SL O
240 L Cha
140 SL ?
142 SL ?
138 L O
232 L C
143 SL ?
149 L C
150 L O
152 L O
160 MS O
206 L O
203 L O
164 MS C
265 SL C
165 L C
264 L C
167 L O
168 L O
260 SL C

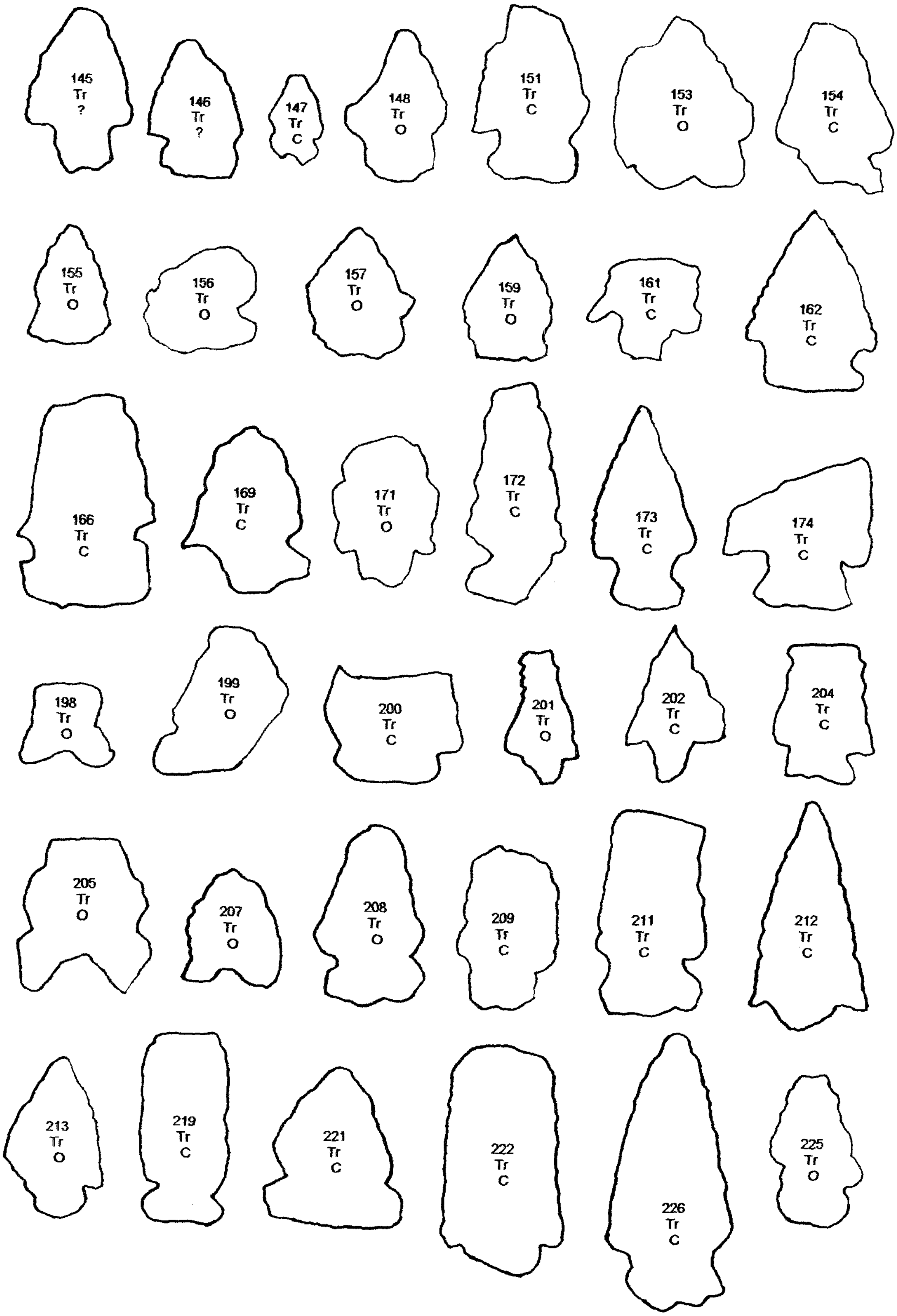

266 L C
267 L O
170 L C
175 MS O
176 MS ?
177 SL C
178 SL Rhy
180 MS O
181 MS O
179 MS O
182 MS NC
183 MS O
365 MS C
184 L C
234 L O
185 MS Rhy
186 MS O
187 L C
235 L C
188 SL O
189 SL C
236 SL C
190 L Cha
191 MS C
192 MS O
193 MS O
233 L C
194 L C
195 L C
214 MS C
215 MS O
268 FCR C
216 SL O
217 L C
270 SL O
280 L C
276 L ?
220 L Cha
291 L C
292 L C
293 L C


294 L C
295 SL C
296 MS C
297 L O
298 L C
223 L Rhy
237 L C
239 L C
238 L C
333 MS O
354 MS C
355 MS O
334 L C
224 L C
335 SL O
356 MS C
336 L ?
337 SL ?
338 L O
339 L ?
341 L C
342 L ?
343 L C
345 SL C
346 L O
347 L O
348 L C
349 SL C
350 L C
351 L PW
352 L C
318 L C
319 L C
320 L C
324 L O
325 L C
326 L C
327 L C
330 L O


329 L C
331 L C
358 MS C
359 SL O
361 FCR O
362 FCR O
364 L O
369 MS ?
10 L C
11 L C
12 SL C
370 MS O
371 L O
1 Tr O
2 Tr C
3 Tr C
4 Tr C
5 Tr O
6 Tr C
7 Tr ?
16 Tr C
9 Tr Cha
15 Tr C
18 Tr C
20 Tr O
22 Tr O
23 Tr C
24 Tr C
25 Tr C
32 Tr O
33 Tr C
37 Tr C
38 Tr C
39 Tr O


40 Tr O
44 Tr C
45 Tr C
46 Tr O
47 Tr C
48 Tr ?
49 Tr O
51 Tr C
52 Tr C
53 Tr C
54 Tr O
55 Tr O
56 Tr Cha
57 Tr O
59 Tr C
60 Tr O
61 Tr C
62 Tr C
65 Tr C
63 Tr C
66 Tr O
67 Tr O
68 Tr C
70 Tr C
72 Tr C
73 Tr O
77 Tr C
83 Tr O
84 Tr C
85 Tr C
87 Tr ?


88 Tr ?
89 Tr ?
90 Tr C
91 Tr C
92 Tr C
93 Tr C
94 Tr C
95 Tr ?
98 Tr ?
99 Tr C
103 Tr ?
104 Tr C
105 Tr ?
106 Tr Q
107 Tr ?
108 Tr ?
109 Tr ?
111 Tr O
113 Tr C
119 Tr C
118 Tr C
120 Tr C
122 Tr C
121 Tr C
124 Tr C
123 Tr C
128 Tr O
129 Tr C
131 Tr C
132 Tr C
133 Tr C
135 Tr ?
136 Tr ?
137 Tr ?
139 Tr ?
141 Tr O
144 Tr ?


145 Tr ?
146 Tr ?
147 Tr C
148 Tr O
151 Tr C
153 Tr O
154 Tr C
155 Tr O
156 Tr O
157 Tr O
159 Tr O
161 Tr C
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166 Tr C
169 Tr C
171 Tr O
172 Tr C
173 Tr C
174 Tr C
198 Tr O
199 Tr O
200 Tr C
201 Tr O
202 Tr C
204 Tr C
205 Tr O
207 Tr O
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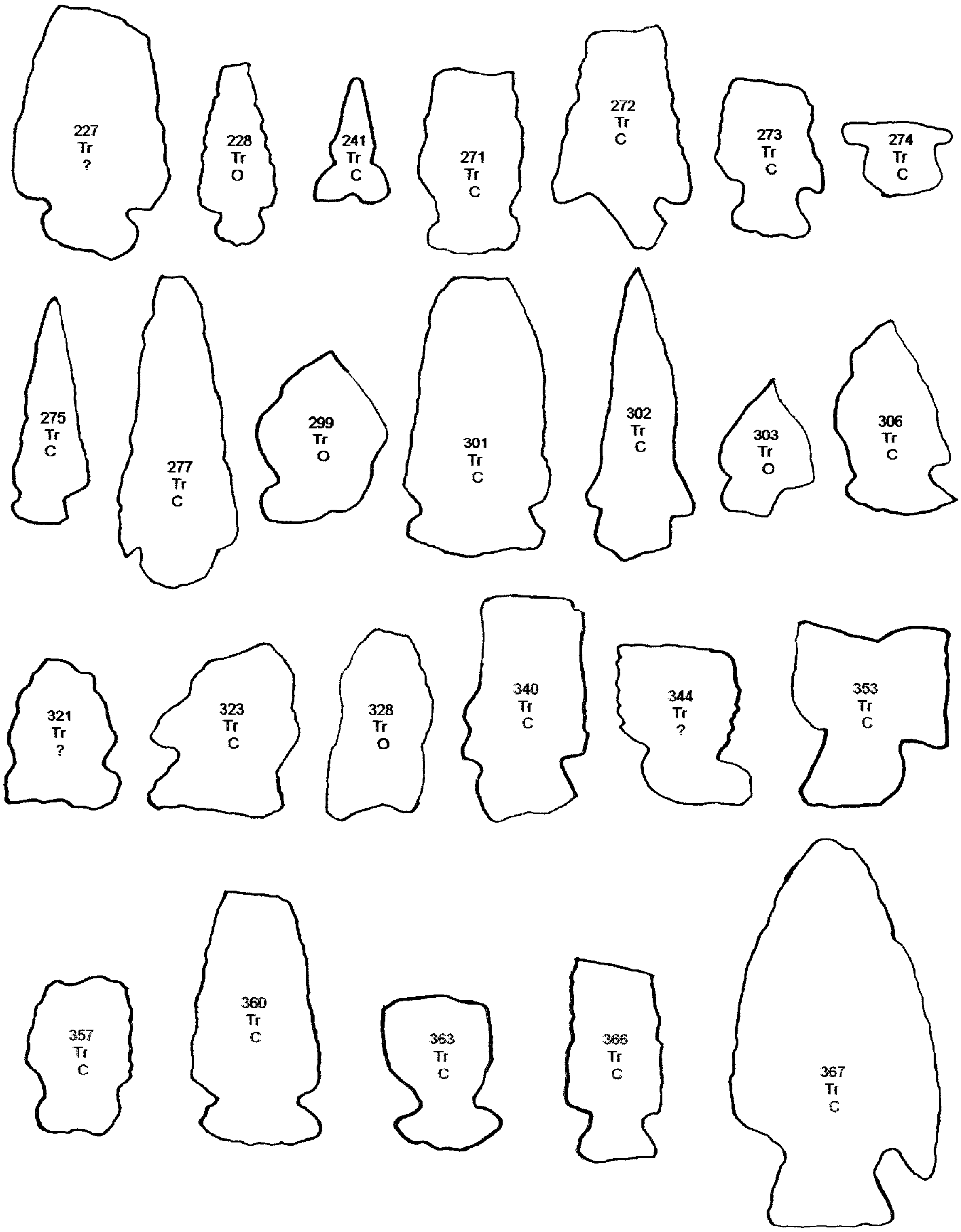
209 Tr C
211 Tr C
212 Tr C
213 Tr O
219 Tr C
221 Tr C
222 Tr C
226 Tr C
225 Tr O


227 Tr ?
228 Tr O
241 Tr C
271 Tr C
272 Tr C
273 Tr C
274 Tr C
275 Tr C
277 Tr C
299 Tr O
301 Tr C
302 Tr C
303 Tr O
306 Tr C
321 Tr ?
323 Tr C
328 Tr O
340 Tr C
344 Tr ?
353 Tr C
357 Tr C
360 Tr C
363 Tr C
366 Tr C
367 Tr C