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Chipped Stone Analysis of the Yamashita Sites in Moapa Valley, Nevada: A Technological Organization Approach

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CHIPPED STONE ANALYSIS OF THE YAMASHITA SITES IN MOAPA VALLEY, NEVADA: A TECHNOLOGICAL ORGANIZATION APPROACH

By

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ABSTRACT

Archaeological research on the lowland branch of the Virgin Branch Puebloan (VBP) has been conducted steadily throughout the 20th century. Much of this research occurred in the early half of the century with initial research conducted by Mark R. Harrington and later archaeology designed as salvage work due to public works projects, including the construction of Hoover Dam and the development of Lake Mead (Ahlstrom and Roberts 2012). The initial archaeology in the area was focused on classifying and characterizing the Puebloan occupation in the region, as the discovery of habitation sites in the area represented the farthest western extension of the Puebloan cultural identity (Harrington 1927; Shutler 1961; Lyneis 1995). Later researchers expanded their research interests to include the study of ceramics, trade patterns, and community organization (Lyneis 1992; Allison 2000; Harry and Watson 2010). Few intensive lithic analyses have been conducted on site assemblages of the Virgin Branch, particularly in the Moapa Valley area of southern Nevada. This thesis uses lithic assemblage data collected from the Yamashita sites, four VBP sites located in the Moapa Valley in southern Nevada dating between the early Pueblo II (PII) period (AD 1000-1020) and the early Pueblo III (PIII) period (AD 1200-1300). The goals of the project are to examine what the tools and debitage at the sites reveal about tool design and how raw material and occupation duration affected these assemblages.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND THEORETICAL FRAMEWORK

Archaeology on the lowland branch of the Virgin Puebloan has been conducted steadily throughout the 20th century. Much of this research occurred in the early half of the century with initial research conducted by Mark R. Harrington and later archaeology designed as salvage work due to public works projects, including the construction of Hoover Dam and the development of Lake Mead (Ahlstrom and Roberts 2012). The initial archaeology in the area was focused on classifying and characterizing the Puebloan occupation in the region, as the discovery of habitation sites in the area represented the farthest western extension of the Puebloan cultural identity (Harrington 1927; Shutler 1961; Lyneis 1995). Later researchers expanded their research interests to include the study of ceramics, trade patterns, and community organization (Lyneis 1992; Harry 2008; Allison 2000; Harry and Watson 2010). Few intensive lithic analyses have been conducted on site assemblages of the VBP, particularly in the Moapa Valley area of southern Nevada. This thesis uses lithic assemblage data collected from the Yamashita sites, four Virgin Branch sites located in the Moapa Valley in southern Nevada dating between the early Pueblo II (PII) period (AD 1000-1020) and the early Pueblo III (PIII) period (AD 1200-1300). The goals of the project are to examine what the tools and debitage at the sites reveal about tool design and how raw material and occupation duration affected these assemblages.

The Yamashita sites were located between the current towns of Logandale and Overton, Nevada (Figure 1.1) and were occupied at different times (Lyneis 2012). They were situated on a terrace overlooking the floodplain, similar to other VBP

Figure 1.1 Map of major VBP sites along the Muddy River.

settlements in the area (Ahlstrom and Roberts 2012). The terrace included several spatially separate and temporally distinct Puebloan occupations (Lyneis 2012). This thesis addresses four of these sites: Yamashita-2 (26CK6445); Yamashita-3 (26CK6446); Yamashita-5N (26CK2041); and Yamashita-5S (26CK2042) (Table 1.1). Yamashita-2 (26CK6445) is the earliest of the sites and represents a PII household (AD 1000-1020). Yamashita-3 (26CK6446) includes a slightly later PII courtyard household unit (AD 1020-1050) and an undated alignment of storage rooms with an unfinished Pueblo I (PI) pit structure. Yamashita-5N (26CK2041) had a PII habitation room. Yamashita-5S (26CK2042) was sampled and found to be a PIII deposit. Dates for these sites were assessed with radiocarbon dates and pottery chronology (Lyneis 2012). Other sites located on the terrace include Yamashita-1 (26CK6444), a partly destroyed Late BMII pit structure; Yamashita-6 (26CK2043); Yamashita-7 (26CK2039); and Yamashita-8 (26CK2040). These sites did not yield assemblages suitable to address the research questions presented in this thesis as Yamashita-1 dated to the Basketmaker periods and Yamashita-6, Yamashita-7, and Yamashita-8 were only surface collected. The Yamashita sites were destroyed soon after excavation as a result of gravel quarrying.

Table 1.1 The Yamashita sites, their associated structures, and dating methods*

Sites	**Associated Structures**	**Time Period**	**Cross-Dated Ceramics**	**Provenience**	**Calibrated Dates**
Yamashita-2 (26CK6445)	2 habitation rooms (PII)	AD 1000-1150	San Juan Red Ware	Str. 4 (Hearth Fill)	AD 1015–1205 AD 1023-1187 AD 1199-1206
				Str. 1 (Salix twig from adobe overlying floor)	AD 1020-1060 AD 1070-1160
Yamashita-3 (26CK6446)	Unfinished pit structure with storage bins (PI); Household courtyard unit (PII)	No direct dates from PI structure AD 800-1000; AD 1000-1150	Tsegi Orange Ware	Str. 3 (Burned maize cob)	AD 990-1160
				Str. 1 Room I (Hearth fill) (Charcoal from burned room floor)	AD 1040–1240 AD 910–920; AD 960–1180 AD 895–925 AD 937–1172
				Str. 1 Room I Room B (Charcoal from burned room floor)	AD 960–1180 AD 898–920 AD 946-1185 AD 1202-1205
				Str. 1 Room A (Hearth fill)	AD 1020-1210
Yamashita-5N (26CK2041)	Habitation room (PII)	AD 1000-1150	Corrugated Utility Ware; Shinarump Red Ware	Hearth Fill	AD 1000-1180
Yamashita-5S (26CK2042)	Deposits (PIII)	AD 1150-1225	Corrugated Utility Ware	Charcoal with corrugated pottery from feature on caliche	AD 1290-1420

*See Lyneis (2012)

Theoretical Framework

Lithic technology found in archaeological settings is often the physical result of regularly conducted activities. Archaeological investigations of this technology can address research questions concerning utilitarian and domestic activities, such as raw material use and subsistence strategies. Research on lithic technology can also allow for inferences on the selected design decisions made during the manufacture, maintenance, and discard of chipped stone artifacts (Andrefsky 2009). Characteristics of a site's assemblage such as artifact form, artifact diversity, tool quantity and type, and raw material preference and selection, can differ as a result of these decisions. It is these characteristics that ultimately signal to archaeologists how lithic technology has been organized by specific populations, given their local conditions. Archaeologists have created and utilized various schemas by which to collect measurable attributes to assess patterns in order to understand these conditions. The data in this thesis were collected to understand these patterns at the Yamashita sites, using the framework of technological organization (Nelson 1991).

Technological organization studies are concerned with the technological strategies implemented in stone tool design during the stages of acquisition of toolstone, manufacture, recycling, and discard. Such studies are similar to chaînes opératoire (Leroi-Gourhan 1943; Sellet 1993), a concept used extensively in lithic studies in Europe to understand the method of core reduction and lithic production sequences. Technological organization was first introduced by Binford (1979) in work focused on the organization of stone tool technology of the Nunamiut Eskimo and was later expanded upon by Nelson (1991). As stated by Nelson (1991: 57), technological organization studies specifically focus on “strategies for making, using, transporting, and discarding tools” by investigating how these strategies are directly affected by environmental, economic, and social factors. Various researchers have used aspects of this approach in case studies or to attempt theoretical advances (Carr 1994; Carr and Stewart 2004; Magne 1985; Odell 1996; Torrence 1989). Their research has suggested that the organization of stone tool technology is foremost embedded in the regular decisions and adaptive choices of tool makers.

Figure 1.2 displays how this relationship takes effect. At the top of the diagram are environmental conditions, which heavily restrict raw material in terms of access and procurement. These restrictions subsequently impact the social and economic strategies involved in prehistoric lithic technology with regard to tool form and design. Thus, resultant artifacts that archaeologists examine are partly the product of environmental limitations such as raw material availability as well as the result of social patterns including subsistence strategies, occupation duration, and learning frameworks. Using a technological organization approach, lithic analysts generally work from the bottom-up, focusing on obtaining measurable attributes from artifact form and artifact distribution to understand how technological strategies used in the creation of these artifacts are impacted by social, economic, and environmental conditions.

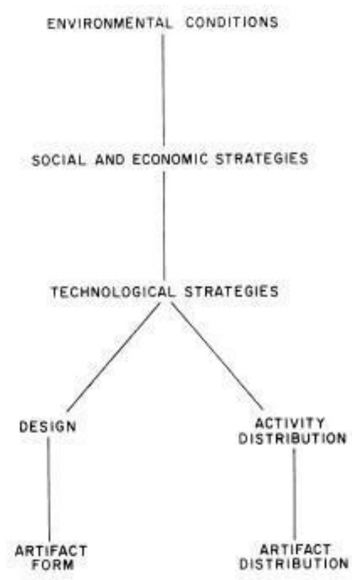

Figure 1.2 Diagram of technological organization approach (from Nelson 1991:59).

The tool design choices at the Yamashita sites can be inferred through this approach as the theory is heavily rooted in understanding the contexts of stone tools as they shift and are re-configured along the continuum of stone tool production. By adopting this theoretical framework, tool design; raw material availability; and occupation duration can be investigated to determine how they affected the lithic assemblages recovered at the Yamashita sites. The purpose of this research is to provide a lithic analysis that addresses how chipped stone was designed and used in relation to the local environmental and social factors during a short, but transitory period of Puebloan settlement in southern Nevada.

Research Questions

In order to assess how the environmental and social strategies affected the organization of the chipped stone artifacts from the Yamashita sites, the following questions will be addressed.

1. **What do the tools and debitage reveal concerning tool design at the Yamashita Sites? How does tool design relate to tool function? Are any changes in tool design apparent over time?**

The design of stone tools is a direct result of risk mitigation, how raw material is used, and how tools' function in site activities. Tool design is often an indicator of the type of risk management strategies used during manufacture and use. If risk is of greater concern, energy costs involved in the initial tool design and the maintenance of stone tools will generally be higher. Tool design choices can also be affected by raw material as risk can often be connected with the selection of toolstone and how it is used. The perception of greater risk, for instance, is often lessened with greater access and availability of raw material. A physical representation of this within a site assemblage may be a preference toward more generalized tool types because risk of tool failure is less of a concern. Lastly, the function of a tool relates to tool design in that tool form is associated with tool function to some degree. While tool function cannot be directly assessed from tool design macroscopically, given that several tool types may function in similar ways, greater artifact diversity with regard to tool design within a site's chipped stone assemblage can suggest greater variability in tool function and a wide range of activities at a site may yield a more diverse tool assemblage and greater variability in tool design.

Tool design is made visible as an archaeological marker through artifact form and artifact quantity. Artifact form allows researchers to identify both environmental and social constraints (Carr 1995) as technological factors of tool production is constrained by the physical nature of raw material and the type of manufacturing techniques used in planning and producing an artifact. Specifically, design variables, as they are emphasized and deemphasized, offer information relative to strategy and planning and the perceived risk of the cost of tool failure. Nelson (1991) explicitly categorized these design variables into five groups: *reliability*, *maintainability*, *flexibility*, *versatility*, and *transportability*. None of these design variables are mutually exclusive and assemblages can have elements of several of them. Yet, to guide discussion, *reliability* and *maintainability* are discussed in opposition to delineate their tendencies, as are *flexibility* and *versatility*.

Reliability and *maintainability* differ according to the assumed cost of failure of a stone tool. If the cost of its failure is perceived to be severe, the tool form will exhibit specific design element choices, such as raw material preference, edge durability, or the presence of sharper edges than necessary. *Reliability* in tool design suggests that a tool was purposefully overdesigned (Nelson 1991; Torrance 1989). Raw material is selected based on whether the toolstone is well-suited to the task, rather than at an opportunistic time. Researchers have identified this design variable in a tool when the artifact appears to have been initially manufactured with more care than was minimally needed for the tool to function for a task (Bleed 1986; Shott 1986). A reliable tool is one that appears to have been manufactured principally for its dependability. Tool form is designed with relatively rigid constraints and little repair should be visible as the tools should have been made stronger or sharper than was necessary for the task at hand (Eerkens 1998).

Maintainability in tool design suggests that a tool was intended to work easily and sufficiently under a variety of circumstances. The cost of failure of the stone tool is perceived to be less severe than that of a reliable tool. Repair occurs more often than complete replacement of tools. *Maintainability* as a design variable has been noted to be visible through a regular occurrence of repair during use (Eerkens 1998). Raw material selection for tool classes may not be as stringent as that of reliably-designed stone tools. Tool design consists of much less rigid morphological tool classes.

Flexibility as a design variable allows for a tool to meet a variety of needs. It differs from *maintainability* in that it is not anticipated that it will have to meet a range of needs, but instead can be modified or reshaped to meet a variety of them, if necessary. Time will also be invested in flexible tools to meet demands, not before a task is at hand, as maintainable tools would be, but at the onset of the task. Therefore, while both variables can aid in meeting the demands of a variety of tasks, the investment in their manufacture differs with additional tool design costs put into a *flexible* tool as necessary. This puts it in contrast to *versatility*. *Versatility*, as a design element, suggests that a stone tool is designed in such a way as to function in a large number of tasks but with minimal necessity of modification or reworking.

Studies concerned with these two variables (Shott 1986; Keeley 1982) have measured these design tendencies through the relationship between the functional attributes of tool and tool maintenance practices. Additionally, Shott (1986) noted these design choices may be visible through tool form. A more flexible type of tool may be identified as a tool displaying “a broader range of functional attributes”; a versatile type of tool may be one “exhibiting a greater number of discrete functional attributes” (Shott 1986; 35).

Last, *transportability* is identified as a design variable by understanding that the proportion of tools and debitage may be directly correlated with the mobility of a group. A transportable toolkit will often exhibit few tool classes and less specialization. The biface is perhaps the epitome of a simple and portable toolkit, allowing for higher mobility as it is capable of functioning in a variety of tasks, including but not limited to, cutting and scraping activities and modification into formalized hafted tools (i.e. knives, projectile points, etc.) (Kelly 1988).

Some researchers (Clark 1999; Simek 1994) have questioned whether these design variables are visible to the researcher investigating an assemblage or a tool. Other researchers have noted specific problems with these variables. For example, Hayden et al. (1996) argued that *versatility* poses problems directly concerning how to differentiate a tool that has been used for a variety of tasks from a tool that has been used repeatedly for the same task, particularly if an edge has been re-sharpened. The aim of a technological organization framework to address tool design and tool function in this thesis, however, is not to explicitly define tools as being exclusively *reliable* or *maintainable,* but for these design variables to be used to infer the possible types of design- making involved in tool construction and maintenance at the Yamashita sites. By doing so, identifying deliberate choices in the design of multi-component or specialized tools may suggest patterns of *versatility* or, for instance, assessing patterns of rigidly designed tool classes may suggest an inclination toward *reliability* as their design would be based on a perceived high risk at the cost of failure of stone tools.

The data necessary for addressing these questions come from the identification of standardized tool classes and their measurable attributes, core attribute data, and the types of debitage seen at these sites. The measurement of chipped stone tool attributes can provide data on manufacturing standardization, stone tool maintenance, use, and diversity to understand tool design and tool function. Core attribute data and differential rates of early-stage and late-stage debitage can identify whether on- or off- site manufacture or on-site tool retouch was a regular activity at the sites so as to better understand the patterns of tool manufacture and maintenance at the sites. Comparing tool form, tool diversity, and the type of debitage seen at the Yamashita sites can help assess whether tool design and tool function differed between the sites and over time.

2. **What do the tools and debitage reveal concerning how raw materials were used at the Yamashita Sites? Were different raw materials used for specific tool types? Did raw material use change over time?**

Raw material availability and the choices involved in maintaining and recycling tools has been a main point of investigation in lithic studies (Andrefsky 1994a; Bamforth 1986, 1991; Carr 1994). Access, availability, and quality of raw material are the greatest constraints on chipped stone technology and will visibly impact assemblages of stone tools and debitage. Researchers have noted certain trends with regard to the local environment and availability of toolstone. Andrefsky (1994a) has noted that locally available lithic materials tend to be used for all types of lithic tools and activities when the toolstone is easily accessible and abundant. This high availability of raw material may be visible through the treatment of toolstone in the assemblages. Bamforth (1986) has also suggested that recycling of tools will only be conducted when there is a shortage of raw material, as there is little reason for individuals to continually transport and rework tools if raw material is readily available. Other work (MacDonald 2011) has demonstrated that the size of curated toolkits tends to decrease in favor of expedient technology in toolstone-rich settings. Additional studies have shown (Carr 1994) that the environment and social and economic strategies are directly related. Research concerns including lithic sourcing and provenance, retouch intensity studies (Clarkson 2002; Kuhn 1991), and risk management (Braun 2005) have demonstrated how these strategies are intertwined and have shown that they can be inferred through the analysis of artifact form and artifact distribution.

The data necessary for addressing these questions come from the identification of raw material of the tool types, cores, and debitage and from obsidian sourcing. If different raw material was selected for different tool classes, then a preference for one raw material over another in a specific tool class can be seen. Flaking patterns and core reduction strategies can indicate how raw material was used and if specific raw materials were conserved over others. Supplementary debitage data can indicate whether any raw material was differentially used during on-site activities. For example, early-stage reduction techniques seen for one raw material may indicate that core-reduction techniques specific to that toolstone occurred at a site in contrast to other toolstone. The presence of late-stage reduction techniques can also indicate that certain raw materials were conserved at higher rates and more heavily retouched than other raw material types. The presence of different raw materials across the sites can be used to determine if a change in the availability or preference of raw material occurred. No difference between the rates and the site activities can suggest little differentiation in raw material use over time.

3. What do the tools and debitage reveal concerning occupation duration at the Yamashita Sites and how did occupation duration affect the recovered tool types?

The strategies involved in settlement and mobility are often tied to concerns such as energy costs, raw material availability, and risk management and can affect how technology is organized. Increased mobility will often create a demand for a reliable toolkit as mobility creates circumstances where risk will limit the time for both manufacture and repair of tools. In contrast, as sedentism increases, material culture and expedient technology tend to increase as the transport costs involved in mobile toolkits are lessened and tools do not have to conform to lighter, more multifunctional designs (Andrefsky 1991; Parry and Kelly 1987). Artifact assemblages of sedentary groups tend to show less time devoted to tool manufacture and repair and increased use of expedient tools (Parry and Kelly 1987). In short, there is an inverse relationship in the cost of manufacture time as occupation duration increases.

Occupation of the Yamashita sites would have been relatively sedentary, with small co-residential family units staying at the sites for a series of years. Planted fields would have been on the floodplains and hunting forays to nearby uplands would have been common. This settlement pattern should suggest that risk costs concerning the reliability of stone tools in the assemblages would be minimal, particularly in the toolstone-rich environment in which the sites existed. Theoretical considerations would suggest that extensive maintenance should not be common and discard rates should be higher than maintenance and reworking activities if occupation duration directly impacted the design of the site assemblages.

The data necessary for addressing these questions come from cores and debitage, as well as the identification of expedient or curated tool technology. Expedient cores with little preparation, as well as a decrease of formal tool use to expedient tool use, can be seen if occupation duration is directly impacting the chipped stone assemblages. Additionally, measuring the degree of curation on chipped stone tools can help infer levels of maintenance. Curation, as first conceptualized by Binford (1973), came to be synonymous with pre- planning and the maintainability of toolkits. In its simplest sense, curation is tied to mobility strategies and how they affect the organization of stone tool technology. Highly mobile groups will adopt a portable tool that has been pre-planned, is easily maintainable, and can be cached or stored as necessary. Risk is reduced by this "gearing up" tactic. To identify these variables, the degree of curation, or the rate at which a tool's actual use relative to its maximum potential use, will be assessed by identifying retouch levels, retouch intensity, and resharpening on the hafted bifacial technology (projectile points) at the sites (Andrefsky 2006). This can be compared further to the rates of broken discarded tools to understand the rates of both maintained and discarded tools.

Significance

This chapter provides the research concerns and theoretical framework for the chipped stone analysis of the Yamashita sites. The research suggests that artifact form and artifact distribution will reveal patterns of tool design, raw material use, and how occupation duration impacts the chipped stone assemblages. The research questions concerning tool design and tool function are focused on technological organization of an assemblage, including the needs of the toolmakers and the local technological trends of manufacture and maintenance. The environmental conditions concerning the access, availability, and quality of raw material within the local area also affect chipped stone assemblages. None of these conditions are solely causal for the organization of chipped stone technology at the Yamashita sites or any other site. Human technological organization decisions are complex and the patterns of production, use, and discard are structured according to the impact of several concomitant local conditions. The significance of this project is to assess whether a technological organization approach can provide data specific to lithic technology in the region.

CHAPTER 2

BACKGROUND: THE VIRGIN BRANCH PUEBLOAN

The prehistoric Puebloan cultural tradition expanded across much of the northern portion of the Southwestern United States. The farthest western expansion of the Puebloan identity is the Virgin Branch where their archaeological remains are found in modern-day Arizona, Utah, and Nevada. The branch is named after the Virgin River system which flows south-southwest from the margins of the Colorado Plateaus in the vicinity of Zion National Park in Utah, across several neighboring states where it cuts across the northwest corner of Arizona and turns south just east of Mormon Mesa in Nevada. Before Hoover Dam was built, it was joined by the Muddy River and flowed into the Colorado River. This branch has been further sub-divided between the geographical settings of the Colorado Plateaus, the St. George Basin, and southern Nevada area (Lyneis 1995). The cultural context found in southern Nevada is referred to as the lowlands and this is the focus of this thesis. This chapter provides discussion relevant to research on the VBP, with emphasis on the lowland area. An overview of previous research at the Yamashita sites is also presented. The aim of this chapter is to elaborate on the research conducted on the VBP to contextualize the data presented in this thesis.

A Puebloan tradition spanned across these geographic areas between AD 200 and AD 1300 (Ahlstrom and Roberts 2012). On the east, the VBP was abutted by the Kayenta branch; to the north, the Fremont tradition; with mobile groups to the west and to the south (Ezzo and Majewski 1996; Lyneis 1995). The lowland portion of the VBP was first identified when a series of sites – *Lost City* – gained attention after Nevada State Governor James G. Scrugham formed a party to explore the archaeological area

(Harrington 1925). In this exploration party was archaeologist Mark R. Harrington who noted that these settlements exhibited evidence of sedentary Pueblo occupation and agricultural subsistence strategies, representative of a Puebloan occupation where it was previously unknown to occur. This put these settlements in direct contrast to the forager tradition of Great Basin populations. Harrington later systematically excavated Main Ridge, a settlement within the Lost City Complex. Additional research has indicated that much of the material culture and settlement strategies were similar to the larger Puebloan cultural tradition, but with a regional identity slightly separate from their easterly neighbors (Lyneis 1995).

Chronology and Material Culture

The VBP archaeological tradition has been classified with the aid of a generalized version of the Pecos Classification (Table 2.1). Spanning from the pre-ceramic Basketmaker II period (AD 1-500) to the end of Puebloan occupation during the Pueblo III period (AD 1200–AD 1300), the VBP is identified by diagnostic material culture, settlement, and subsistence practices in contrast to forager groups. From the earliest periods to the eventual dissolution of the tradition in the area, alterations occurred in architecture, settlement practices, and material culture. Diagnostics of settlement and material culture include specific types of locally and non-locally produced ceramics, accretionally-built co-residential habitational sites, and a horticultural subsistence strategy. The branch stretched across a wide stretch of geographical areas, resulting in intravariability of these characteristics. Because of this, chronology and settlements discussed here are primarily focused on sites in the Muddy and Virgin River Valleys.

Table 2.1 Virgin Branch Puebloan chronology and characteristics (modified from Ahlstrom and Roberts 2012: 126).

Period	**Dates**	**Ceramics**	**Sites**	
Pueblo III (PIII)	AD 1200 – 1300	At least 50% corrugated utility ware; Shinarump Red Ware	Mesa House; Adam-2; Yamashita-5 South	
Late Pueblo II (PII)	AD 1150 – 1200			
Middle Pueblo II (PII)	AD 1050 – 1150	<10% corrugated; Tsegi Orange ware	Main Ridge; Yamashita 5 North; Yamashita-3 Courtyard	Steve Perkins (late)
Early Pueblo II (PII)	AD 1000 – 1050	<10% corrugated; San Juan Red Ware	Yamashita-2	
Pueblo I (PI)	AD 800 – 1000	No corrugated	Yamashita-3 South*	Black Dog Mesa (Locus 4); Steve Perkins (early); House 102; Cliff's Edge
Basketmaker III (BMIII)	AD 500 – 800	Plain and decorated gray wares		
Late Basketmaker II (BMII)	AD 1 – 500	Preceramic	Black Dog Cave; Black Dog Mesa (Locus 4); Yamashita cists; Yamashita-1 (pit structure)	

*no associated ceramics, structure not completed

Late Basketmaker II (BMII) and Basketmaker III (BMIII)

Much of the research and excavation of Puebloan sites in the Lowland VBP area was conducted in the first half of the 20th century, with the heaviest concentration of work conducted on sites spanning from the PII (AD 1000–1200) to the PIII periods (AD 1200–1300). Little modern data have been collected from sites in the lowland area dating to the Basketmaker periods. Systematic archaeological excavations in the Moapa Valley began in the 1920s directed by Mark R. Harrington (Ahlstrom and Roberts 2012). Later work was conducted by workers in the Civilian Conservation Corps (CCC). Data from many of these earlier investigations have been compiled by various researchers (Shutler 1961; Harry et al. 2008). Additional archaeological evidence has shed light on the earliest periods of occupations.

During the Late BMII period (AD 1-500), open-air sites and rock shelters were used. Open-air sites consisted of a small number of pithouse structures with interior hearths and clay floors. Rock shelters had semi-subterranean cists. Dart points dominated the chipped stone hunting technology, showing continued use of atlatl technology. BMII sites are pre-ceramic. The most well-known of the sites in the lowland area from BMII is Black Dog Cave, first excavated by Harrington in 1924 and later revisited as part of the documentation of the Black Mesa Archaeological Complex (Winslow 2009). Black Mesa Archaeological Complex also included Black Dog Mesa (Locus 4), where two pithouses dated to the BMII period. Two additional pithouses at Black Dog Mesa (Locus 4) dated to the later BMIII (AD 500-800) and PI (AD 800-1000) periods. Logandale Gray Ware ceramic sherds were recovered from the pithouses (Winslow 2009). Logandale was locally-produced within the Moapa Valley area and the lower Virgin Valley by around AD 500 (Lyneis 2008; 2012). It continued to be produced until the PII period in the valley.

Pueblo I (PI)

The Pueblo I (AD 800 – 1000) period also has not been heavily researched. Substantial changes between BMIII times and PI occurred. The primary differences between PI and Basketmaker III times are in the kinds of ceramics and architectural forms found (Altschul and Fairley 1989). Gray wares and black-on-gray wares were the most common ceramics found and pithouses remained the primary habitation structure. The most notable site of this time period in the valley is the Steve Perkins site, where an early component has been suggested to date between AD 650 to 950 (Ahlstrom and Roberts 2012). Excavations of the site resulted in an unpublished report, but provided data relevant to settlement, subsistence, and material culture. In the early component of the site, five structures showed pithouse use and the use of domesticates during this period (Myhrer 1989). Material culture demonstrated the use of bow-and-arrow technology and the continued production of local gray ware, which dominated the early component's ceramic assemblage. A non-local ceramic, Moapa Gray Ware, was also present and accounted for 38% of the ceramics (Myhrer 1989). This ceramic was produced between BMIII and Late PII near Mt. Trumbull on the Uinkaret Plateau in Utah and was distributed to the west, north, and east through established trade networks between the VBP regions (Lyneis 2008).

Pueblo II (PII)

By the Pueblo II Period (AD 1000–1200), population was at its greatest in the region and settlement architecture changed with the use of adobe above-ground room blocks (Lyneis 1995). Bovine Bluff is the most well-known site in the valley dating to the early PII period (AD 1000-1050) (Lyneis and Myhrer 1985). Weathering of the structures obscured the architecture during excavation of the site, but an alignment of adobe-lined walls was identified. The chipped stone assemblage suggested a dependence on hunting activities. A high frequency of jar pottery forms also showed possible agricultural activity. Thus Bovine Bluff represents an early PII occupation where a hunting and gathering culture was shifting toward a greater dependence of agriculture.

The locally-produced Logandale Gray Ware was seen in high proportions and accounted for 57% of this site's ceramic assemblage (Lyneis and Myhrer 1985).

Most of the data concerning VBP occupation in the Moapa Valley date to the middle to late PII period (AD 1050-1200). Structures are known to have been aligned in a curvilinear design with habitation rooms often on either side of room blocks. The interior rooms, smaller in size, are thought to have been designed as storage rooms. Variability within site layouts and site size and construction occurred at sites in the area. However, this preferred site layout is found at several sites in the lowland area including Adam-2 (Lyneis et al. 1989) and Main Ridge (Lyneis 1992). Rooms during this time were primarily made of mud and adobe with some added stone. Wood was scarce in the area. Villages of large aggregation are rarely noted in the region and only a few exceptions, such as at Main Ridge (Lyneis 1992), had a site population greater than small groups of several families cohabiting at one time (Lyneis 1995).

The PII period marked the presence of the most ceramic variation in the region and the greatest levels of intraregional exchange (Harry 2005). The locally made Logandale Gray Ware, which was present in great quantities in earlier time periods, became rare by middle PII. Use of corrugated jars began in the middle of PII with corrugation seen in the Moapa Valley by about AD 1050. By the end of the period, 20% of the many site assemblages were corrugated wares (Lyneis 2012: 157). The presence of Moapa Gray Ware from the uplands peaked with high proportions in ceramic assemblages by middle PII in the Moapa Valley (Allison 2000; Hays-Gilpin and Lyneis 2007). Other ceramic trends noted in the region included the presence of Shivwits ware until the late PII with high proportions of it in ceramic site assemblages of Middle PII sites (Allison 2000; Harry et al. 2013). Lower Colorado Buff Ware is seen in quantities at the end of this period (Lyneis et al. 1989). Red ware also appeared between the mid- AD 1000 to 1300s.

San Juan Red Ware is the most common red ware seen at early sites in the area, followed by Tsegi Orange Ware, and Shinarump Red Ware. San Juan Red Ware was produced around AD 750 in the southeastern Utah region north of the San Juan River and Tsegi Orange Ware was produced around AD 1000 in the Kayenta region (Hegmon et al. 1997). Shinarump Red Ware was produced in the eastern Grand Canyon area (Collete 2009). As Tsegi Orange Ware was imported into the Moapa Valley in the middle of PII, San Juan Red Ware production is noted to decline and its appearance in Moapa Valley site assemblages waned. At Yamashita-2, 1% of the ceramic sherds (n=11,212) were redware and were primarily San Juan Red Ware. At Yamashita-3, 2% (n=6,306) of the ceramic sherds were redware and were primarily Tsegi Orange Ware (Allison 2000; Lyneis 2012). Ceramic assemblages consisted mostly of gray utility ware.

Extensive trade networks are also seen with regard to other material culture. Ornaments and their raw materials were traded into the Moapa Valley and are seen in PII contexts (Lyneis 1992) in the form of *Haliotis* shell pendants from the coast of California and “disk beads of *Spondulus, Olivella dama* barrel beads, and bead pendants of *Spondylus*” made from shells from the Gulf of California (Lyneis: 1995: 231). Fragments of *Glycymeris* shell bracelets also have been found at sites in the area (Shutler 1961; Lyneis 1995). Communities in the Moapa Valley, acting on the frontier of the VBP area may have acted as a vital link in the collection and transport of these trade commodities (Lyneis 1995).

Turquoise has been found in raw form and as ornaments in small numbers at sites. During excavations at various Lost City sites, both forms were recovered in burial and non-burial contexts (Shutler 1961). Turquoise exploitation and trade has been identified through sourcing of artifacts from the Steve Perkins site and Yamashita-3 as well (Hull et al. 2014). Hull's study identified long-distance trade networks and the movement of turquoise extracted from sources including Halloran Springs, Crescent Peak, and Sullivan Mine near Boulder City, further east to an upland site, Eagle's Watch, south of Kanab, Utah, and Aztec Ruin and Salmon Ruin in New Mexico. The turquoise sample from the Steve Perkins site also indicated turquoise trade back into the valley from the east. Previously, Rafferty (1990) suggested that Puebloan populations in the Moapa Valley were exploiting turquoise from sources to the west of the Moapa Valley. Hull's study supports Rafferty's suggestion and further indicates that lowland inhabitants participated in a long-distance trade possibly through down-the-line trade or formal trade networks involving the collection and transport of turquoise.

Pueblo III (PIII)

During the PIII period (AD 1200-1300), population declined, but traits remained similar. Surface habitation and storage rooms continued through this period and the ratio of storage-to-habitation rooms remained high. For instance, at Mesa House, only three to five of the rooms of the 33 structures excavated were determined to be habitation rooms (Lyneis 1986). The locations of sites changed with a shift upland to mesas or higher terraces in contrast to the low knolls preferred in the PII period. Corrugated wares accounted for the majority of ceramic in assemblages during this period. At Mesa House, 69% of the ceramic assemblage was corrugated ware (Hayden 1930: 72). Also, red ware polychromes first appeared during this time but remained relatively uncommon (Allison 2000).

Unlike other Puebloan branches, kivas are not present in the lowland area during this period or before it (Shutler 1961)(Lyneis 1995). Kivas represent structures used for ritual activities supply a social means of integration (Lipe and Hegmon 1989) and are found at various Puebloan settlements. Kivas are not present in the lowland area. probably since large sites were rare in the region and aggregation uncommon. Other social mechanisms to promote integration and maintain social and economic ties were likely in place.

Post-Puebloan

Following the PIII period, the VBP are no longer visible archaeologically. Theories of climatic change, like drought (Larson and Michaelson 1990) or warfare between the Puebloan population and foragers entering the region (Ambler and Sutton 1989) have been suggested as reasons for the end of the Puebloan presence in the area. Larson and Michaelson (1990) suggested a mid-twelfth century drought using tree-ring data, proposing that this drought would have caused erosion of the Virgin River and its tributaries (Ahlstrom and Roberts 2012). However, a 12th century drought has been argued against (Allison 1996) as a cause of abandonment, as it has been noted that the Muddy River's spring-fed nature would have decreased a drought's impact. Additionally, researchers have also documented Puebloan occupation after AD 1150, at various sites including Yamashita-5S (Lyneis 2012), Adam-2 (Lyneis et al. 1989), and Mesa House (Hayden 1930) indicating that populations remained in the area during this time.

Conflict between different populations has also been proposed. Ambler and Sutton (1989) suggest site placement atop terraces as a defense against raids. This suggestion has been difficult to assess. Data obtained from overlying thermal features at Yamashita-2 suggest that Puebloan and Southern Paiute occupied the area close in time in the AD 1300s, but direct conflict in the region has not been seen archaeologically. The skeletal data collected by Martin and Thompson (2008) of 37 sets of human remains from Lost City sites suggested that the remains represented a possible heterogeneous population (as seen through varied cradle boarding practices and skeletal morphology). This may suggest a more inclusive population than a homogeneous, exclusive one. Current data suggest no sole impetus for the Puebloan abandonment. It is likely, as has previously been suggested, that a multi-causal explanation with a combination of environmental conditions, demography, contact and assimilation of forager populations, marked the end of the occupation (Ahlstrom and Roberts 2012).

Subsistence and Settlement

The VBP spread across an environmentally variable region. Settlements in the upland settings of Arizona are found on the Colorado Plateaus, primarily around perennial tributaries and run-off locations (McFadden 1996). Settlements in the lowlands include those found in southern Nevada and the St. George Basin (Lyneis 1995) and these are specifically oriented along the Muddy and Virgin Rivers on terraces that overlook the floodplains. Ahlstrom and Roberts (2012: 115) noted that these sites span "a distance of 50 to 60 miles along the two rivers—including a 5-mile stretch of the Virgin River in far northwestern Arizona".

Differences in settlement patterns were the result of the environment. In the St. George Basin, the Virgin River acts as a rain-fed water system. This river would have been more affected by drought conditions than its tributary, the Muddy River, which is spring-fed. On the other hand, the flow of the Muddy River would have remained relatively constant throughout Puebloan times, allowing for farming in the portions of arable land in the Moapa Valley despite climatic perturbations (Lyneis 1995). A majority of the settlements in the area are situated on the alluvial fans of the Muddy River's floodplain, taking advantage of the more consistent access to water.

Research over the past two decades has suggested that during the time span between the late BM period and the early PIII periods, the VBP practiced a mixed subsistence strategy of cultivation and hunting-and-gathering. The trajectory by which the diffusion of farming technology occurred is not known. Early evidence of maize farming in the Las Vegas Valley comes from the Larder-Scorpion Knoll site as early as 350 BC (Ahlstrom and Roberts 2012), several centuries before it is noted in the Moapa Valley. Ahlstrom and Roberts (2012) have suggested this date provides the possibility of farming technology coming up from the Lower Colorado and Gila River, rather than ancestral Puebloan communities to the east.

Within the Moapa Valley, early cultigens were noted at Locus 4 of Black Dog Mesa dated to BMIII (AD 500-800). Charred plant remains collected at the site, included maize in the form of kernels, cupules, and cobs and *Cucurbita* (pumpkin, squash or gourd). Wild plants, such as tansy mustard and amaranth, were also identified during analysis (Winslow 2009, 586). In the lowland area, plant foods including maize and wild screwbean mesquite, were identified at both Main Ridge and Mesa House

(Lyneis 1992; Hayden 1930). This use of wild plants alongside cultigens has been explored by other researchers (Harry and Watson 2010), countering earlier research (Larson 1996) suggesting that populations in the area had little reliance of wild plant exploitation.

The environmental diversity of the region likely resulted in variation in the degree of exploitation and cultivation of wild plants. The most current research indicates a mixed economy rather than a solely horticulturalist economy during the Puebloan periods. Macrobotanical samples collected at one house at Lost City show a record of cultivated plants including maize, squash, beans, as well as exploitation of wild plants such as cattails, prickly pear, cactus, amaranth, saltbush, goosefoot, tansy mustard, mesquite, and various grasses (Harry and Watson 2010). This House is unusual, however, given its lack of a hearth. Faunal remains across the region also demonstrate the inclusion of desert bighorn, rabbits and hares, desert tortoise and various birds in the diets of the populations (Ahlstrom and Roberts 2012). At the Yamashita sites specifically, faunal analysis has yet to be completed (Lyneis 2012).

Yamashita Sites

The Yamashita sites were excavated under the supervision of Dr. Margaret Lyneis between 1989 and 1997. Excavations were conducted during a Saturday field school by students and volunteers involved in a Continuing Education program. The sites represent a VBP occupation on the east side of the Moapa Valley between the towns of Overton and Logandale, Nevada on a terrace called Sand Bench. The Sand Bench is an aeolian sand-topped terrace, overlooking the floodplain of the Muddy River. Various occupations were documented during excavation spanning from the Late BMII period to early PIII times. Excavations were focused on five of the nine identified sites. Later Southern Paiute use was also noted by the presence of Great Basin Brown Ware. The following site data were gathered from Lyneis (2012).

Yamashita-2 (26CK6445) had four Pueblo II structures, two of which contained habitation rooms, Structures 1 and 4 (Figure 2.1). Lyneis noted that it was possible that these structures may have represented one continuous roomblock, but that eroded storage rooms and looting activity prevented confirmation.

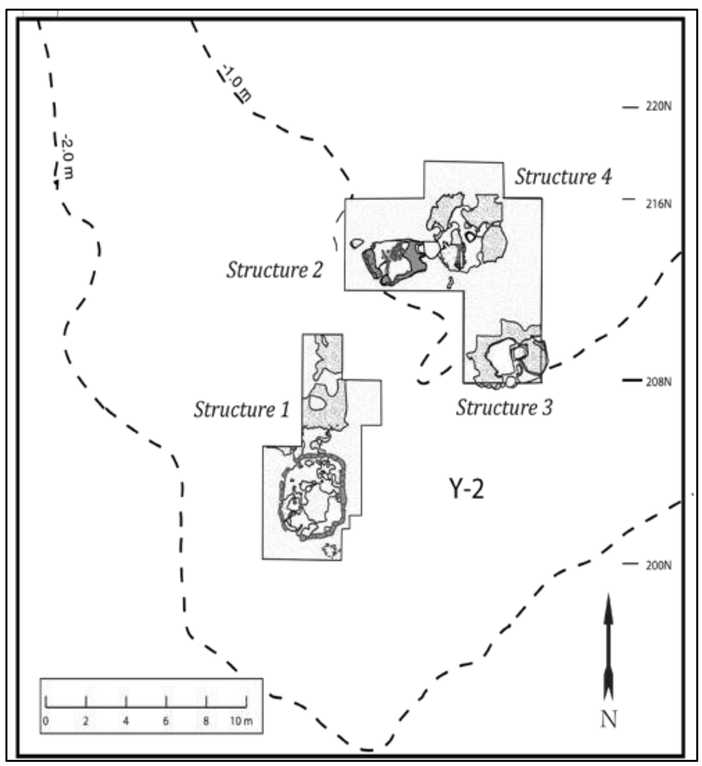

Figure 2.1 Yamashita-2 (26CK6445) site map (from Lyneis 2012).

Structure 1 (Figure 2.2) is on the southern end of the site. Its habitation room was connected to attached storerooms oriented north to south. The attached storerooms had been heavily eroded. The habitation room of the structure had its center destroyed by looters, possibly destroying its central hearth in the process. Its floor consisted of a layer of light colored clay plaster. No floor assemblage was recovered from the room. Structures 2, 3, and 4 were contemporaneous with their floors at the same level. Structure 2 was a storage room, as suggested by its size. It contained a floor and the partial remnant of an adobe wall. On the floor was a ceramic scoop made from a St. George Black-on-Gray bowl. The function of Structure 3 was unclear, but it likely was a storeroom. Structure 4 was a habitation room. Pothole damage between the structures made it impossible to determine whether the rooms were connected or Structure 4 was a stand-alone room. An unrimmed bowl-shaped hearth was built in the center of the room. It was clay-lined and dug through the floor. A thick layer of adobe was above the floor. Several utility ware sherds were recovered from the floor and in the hearth fill. Dates obtained from the central hearth of Structure 4 (cal. AD 1023-1187) and a *Salix* twig from the adobe rubble above Structure 1's floor (cal. AD 1070–1160) suggest it may have been an isolated habitation structure or that it may have been connected to the roomblock of Structure 1.

Figure 2.2 Yamashita-2 (26CK6445), structure 1 plastered floor (from Lyneis 2012).

Other excavation units around the structures indicated that the only outdoor activity occurring at the site was trash dumping. Lyneis (2012) noted that the trash was deposited as sheet middens, possibly as a means to stabilize the sand. The highest concentration of trash fill was located to the southeast of the structures. Units in this area yielded counts of 300 to 400 sherds each. The ceramics from the site consisted mostly of local gray and brown ware. Utility ware at Yamashita-2 was mostly local Pueblo ware and not the later introduced Shivwits ware.

Yamashita-3 (26CK6446) had two distinct sets of structures: Structure 1 to the north and Structure 2 to the south (Figure 2.3). Structure 1 is a classic PII courtyard unit, which opened to the south (Figure 2.4). A habitation room was on either end of a connected curve of storage rooms. Another large room (Room A) on the eastern end of the roomblock was attached to the habitation room. This room contained a clay-lined rimmed hearth which yielded a radiocarbon sample of cal. AD 1020–1210 and a pollen sample that indicated use of cholla and maize use. The habitation room (Room B) attached to it had been burned and charcoal from the floor was dated to cal. AD 960–1180. The storerooms (Rooms C through H) connecting this habitation to the one on the west side were heavily eroded. At least two store rooms were identified and yielded charcoal samples at the base of its east wall. Cattail pollen was also recovered from the store rooms. The habitation room on the west end was burned after a burial was placed in it below its floor. Ashy fill from the clay-lined hearth of this room yielded a date of AD 1040-1240.

Structure 2 in the southern portion of the site consists of a line of storage rooms that may have acted as reach-in bins that could be accessed from the top, similar to other sites in the region like Adam-2 (Lyneis et al. 1989). Beyond the opening of the reach-in bins, the floors of the bins could not be followed by the excavators. An unfinished pit structure was uncovered to the east of the storage rooms. No dates were obtained from these structures. Structure 2 may have been contemporaneous to Structure 1 or it may be have been an unused structure dating to PI, as suggested by the pithouse and storage layout. Sherd densities in the trash fill of Yamashita-3 were less than Yamashita-2. Units opened between the two sites suggested that the sites had separate trash deposits: on the west end of the site and to the northeast. Tsegi Orange Ware dominated this site's redware assemblage with 80%, further indicating a post-1000 A.D occupation.

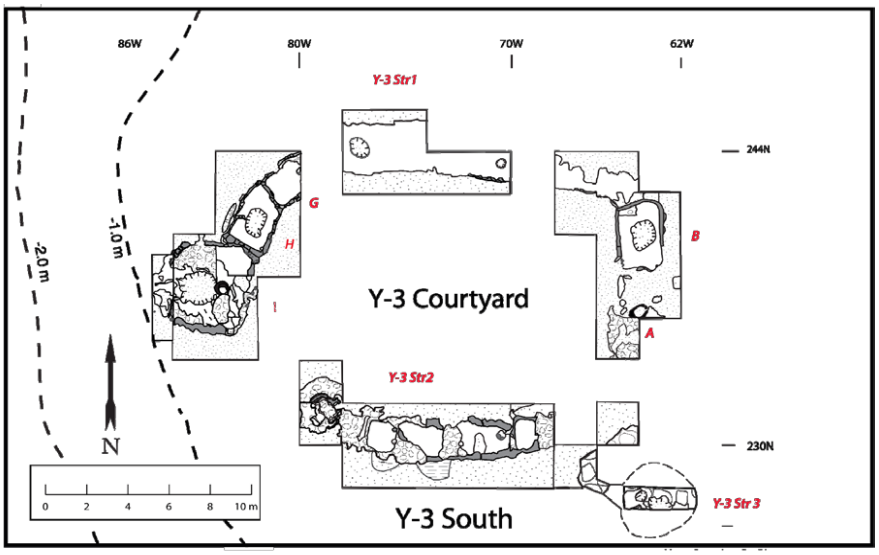

Figure 2.3 Yamashita-3 (26CK6446) site map (from Lyneis 2012).

Figure 2.4 Yamashita-3 (26CK6446), structure 1 rooms G H and I (from Lyneis 2012).

Yamashita-5N (26CK2041) was excavated on a smaller scale than Yamashita-2 (26CK6445) and Yamashita-3 (26CK6446). A test unit determined that this site was a late Pueblo II habitation room (Figure 2.5). The room had a rimmed, clay-lined hearth that was undisturbed under adobe rubble and provided a radiocarbon date of cal. AD 1000-1180. Yamashita-5S (26CK2042) was sampled and surface collected. It showed a high proportion of corrugated utility ware (70%), placing it as a later occupation as a late PII/ Early PIII site. At Yamashita-2, Yamashita-3, and Yamashita-5N corrugated ware was less than 10% of the utility ware. A trash deposit suggested a structure to the east, but time limitations did not allow for excavation. A deposit of burned rocks and dark stained sand yielded a radiocarbon date of cal. AD 1290–1420.

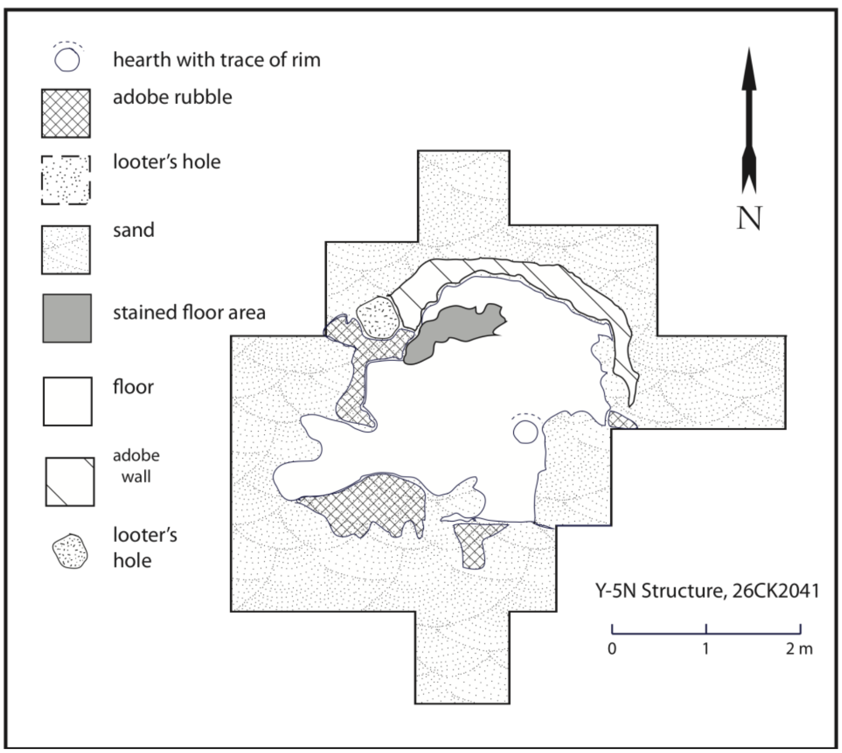

Figure 2.5 Yamashita-5 (26CK2041), PII habitation room (from Lyneis 2012).

Many of the sites on Sand Bench were destroyed due to modern construction and housing development. These sites are primarily known through site records collected over the years. The excavation of the Yamashita sites allowed for temporal data to be collected between several adjacent sites, unlike occupations in the area, which are generally limited to single-site excavations. Excavations revealed that the Yamashita sites were occupied closely in time but not occupied contemporaneously.

CHAPTER 3
METHODOLOGY

This thesis uses data from the chipped stone assemblages recovered from the Yamashita Sites (Table 1.1), a series of four VBP settlements excavated between 1989 and 1997. Chipped stone is an artifact category that classifies lithic material that has been detached from larger parent pieces through the use of percussive force (Andrefsky 2005). All chipped stone tools from these assemblages, whether purposely designed or expediently used, were included in this analysis. Any tools that had evidence of chipping manufacture but exhibited primary use as a grinding implement were not included. To further understand the strategies of lithic production at these sites, a percentage of debitage was sampled to provide supplementary data.

Analysis Methods

Chipped stone tools were analyzed using a technological organization framework as discussed in Chapter 1 (Binford 1979; Nelson 1991). This approach assesses how environmental and social conditions affect the choices involved in the manufacture, use, and maintenance of lithic technology and allows for the collection of measurable attributes to identify patterns in the acquisition, investment, and use of raw material during the stages of production, transport, use, and discard of stone tools. This thesis is specifically concerned with how tool design and form are affected by occupation duration and raw material availability at the Yamashita sites. Because a technological organization approach directly focuses on how environmental and social strategies impact flintknapping choices, it was favored as the framework by which to direct the lithic analysis.

The chipped stone tools originated from various contexts including habitation, storage, and midden fill. Few artifacts were found on the floors of habitation units. Artifact identification was limited to macroscopic identification or with the aid of a low-level hand lens. Microwear analysis was not used in this analysis. As such, the actual function of the tool was not assessed. The assemblages from two of the Yamashita sites: Yamashita-2 and Yamashita-3 are comparable in size. The assemblages from Yamashita-5N and Yamashita-5S are substantially smaller, particularly as only a small portion of Yamashita-5S was excavated due to time constraints (Lyneis 2012) (Table 3.1).

Table 3.1 Total number of artifacts analyzed.

Site Name (Site No.)	**Total Tool Count**	**Total Core Count**	**Total Debitage Sampled**	**(% of Debitage Assemblage)**	**Entire Debitage Assemblage**
Yamashita-2 (26CK6445)	340	21	832	(4.4%)	18,848
Yamashita-3 (26CK6446)	281	22	2,109	(19.4%)	10,839
Yamashita-5N (26CK2041)	18	2	251	(36.1%)	696
Yamashita-5S (26CK2042)	31	4	494	(39.5%)	1,250
TOTAL	**670**	**49**	**3,686**	**(11.7%)**	**31,633**

For this analysis, chipped stone from the Yamashita sites were divided into general categories including: bifaces, unifaces, core tools, composite tools, cores, and debitage. Attributes recorded for all categories included: raw material type, condition, metric dimensions (length, width, thickness), weight, percentage of cortex, edge shape, edge angle, and location of retouch and were adopted from Andrefsky (2005) (Table 3.2). Condition included: complete, near-complete (approximately 80% of the artifact intact), or fragmentary. Metric dimensions were measured with digital calipers and maximum length and thickness measurements were obtained. Width was measured perpendicular to maximum length measurements. Weight was determined using a digital scale and recorded in grams. The percentage of cortex on complete or near-complete artifacts was recorded in the following categories: 0, 1 to 10, 11 to 40, 41 to 60, 61 to 90, 91 to 99, and 100 percent. The cortex on incomplete artifacts was recorded as present. Edge shape was recorded as convex, concave, or straight. Edge angle was recorded with a manual goniometer and fell into one of the following categories: 25 to 40; 40 to 50; 50 to 80. Location of retouch was recorded. Table 3.2 demonstrates how these attributes relate to the research questions of this thesis. Attributes addressing Research Question #1 assess the levels of standardization in tool form and design and the maintenance of stone tools. Attributes addressing Research Question #2 assess how reduction strategies and raw material use were related. Attributes addressing Research Question #3 focus on occupation duration, the use of expedient technology, and discard and maintenance rates.

Table 3.2 List of tool attributes and the research questions addressed.

Attribute	**Definition**	**Research Question Addressed**
Tool Type	Projectile point; unhafted biface; drill; knife; scraper; denticulate; composite tool; chopper; core tool; retouched flake	1, 2, 3
Raw Material	Chert, chalcedony, quartzite, obsidian, rhyolite, sandstone, diorite, limestone, basalt	2
Condition	Complete, fragment, proximal, distal	2, 3
Location of retouch	Lateral; end	1
Edge Angle	25 to 40; 40 to 50; 50 to 80	1
Edge Shape	Concave, convex, straight	1
Percent of Cortex	0, 1 to 10, 11 to 40, 41 to 60, 61 to 90, 91 to 99, 100 / Absent or Present	2, 3
Metrics	Length; width; max thickness; weight (g)	1
Obsidian Sourcing	17 artifacts were sent to Northwest Laboratory for analysis.	2

Biface Technology

Bifacial tools are those tools that have been purposely flaked on both their faces with an edge that circumscribes the entire tool (Andrefsky 2005). Bifacial technology at these sites included unhafted bifaces, knives, drills, and projectile points. Attributes recorded for bifaces included: condition, number of retouched edges, location of retouch, edge shape, edge angle, metric dimensions (length, width, and thickness), and weight (grams). The degree to which bifaces have been worked varies based on design and tool use (Andrefsky 2005; Kelly 1988). The stages of biface reduction have been provided in different models in the literature (Andrefsky 2005, Whittaker 1994). This analysis identified biface stages by utilizing a five-stage model (Andrefsky 2005), with unhafted bifaces represented as Stage 1 Blank; Stage 2 Edged Biface; Stage 3 Thinned Biface; Stage 4 Preform; Stage 5 Finished Biface.

Unhafted bifaces include general bifaces with flake scars evident across both faces of the tool. They can vary in form from a crudely flaked artifact to a more finely thinned and shaped biface. The degree of the edge angle and the flaking pattern was recorded in this analysis to categorize these bifaces. Other bifaces include drills and knives. Drills are bifacially flaked tools used to perforate or punch through various materials. The morphology of drills varies considerably in form and size. However, tools of this type all share a thin and extended bit, sometimes with a diamond cross-section on the distal end. The base of a drill also can vary from an outwardly expanding T-shaped base to a narrow proximal end. Knives are a general term to represent an extensively flaked tool that is relatively thin and flat in its cross-section and is finely pressured flaked along most edges, particularly the length of the blade. Knives have been identified in VBP assemblages as hafted stone tools (Hayden 1930).

Projectile points are finished bifaces with hafting elements on their base. Different hunting technology strategies and needs necessitated the design of projectile points to act as either arrow or dart points and as projectiles for bow-and-arrow or atlatl technology (Andrefsky 2005). Additionally, projectile points may carry significance separate from their utilitarian nature as ritual objects. In this analysis, projectile points were classified according to existing typologies for the region (Thomas 1983; Justice 2005) and included Rosegate, Parowan, Desert Side-Notched, and Cottonwood. Several dart points were also recorded. Additional attributes recorded for projectile points included width at midpoint (WMP), stem width (SW), minimum stem diameter (MSD), and thickness at MSD

(Figure 3.1). Condition of points were recorded as complete (< 90%), midsection, distal, base, or fragmentary. Breaks and evidence or reworking on the incomplete projectile points were also recorded. Their location (tip, tang, barb, midsection, stem) and, if possible, what type of break, was recorded for each broken projectile. Breaks included: snaps, perverse fractures, stem bends, reverse hinge fractures, and inclusion breaks. Specific breaks are more likely to occur as the result of manufacturing errors (i.e., inclusion, perverse fractures) or use-impact (i.e., snap). Reworking of projectile points was also recorded by location. Identification of these attributes assist in understanding how risk was being mitigated by understanding repair techniques against discard rates.

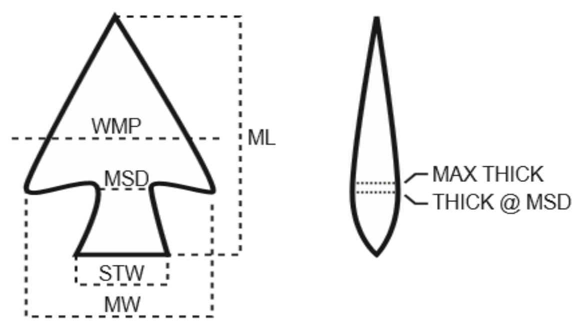

Figure 3.1 Measurements taken from one type of hafted biface.

Because the assemblages had a large percentage of projectile points, additional measurable attributes were recorded. To assess the level of retouch occurring on these tools, all complete projectile points underwent a specific retouch measurement scale. This scale was a hafted biface retouch index (HRI) (Andrefsky 2006). HRI was favored for this analysis as it allowed for a standardized method to assess the level of resharpening of projectile points across typological series. While HRI does not provide an absolute measure of raw material retouch, it provides a relative measure between tools in an assemblage.

To obtain these values, HRI focuses on the blade element of projectile points to assess whether raw material has been differentially reworked. Figure 3.2 displays how the measurements were taken. During analysis, projectile points were divided according to known typological series. The blade of the projectile point was then divided into 16 segments (eight segments on the dorsal side and eight segments on the ventral side). Each segment of the blade is given a score of 0, 0.5, or 1 based on the invasiveness of the retouch and then averaged. The hafting elements are excluded with the expectation that that portion of the tool would generally be heavily flaked and skew the results. This measurement was specifically used during this analysis as researchers have suggested

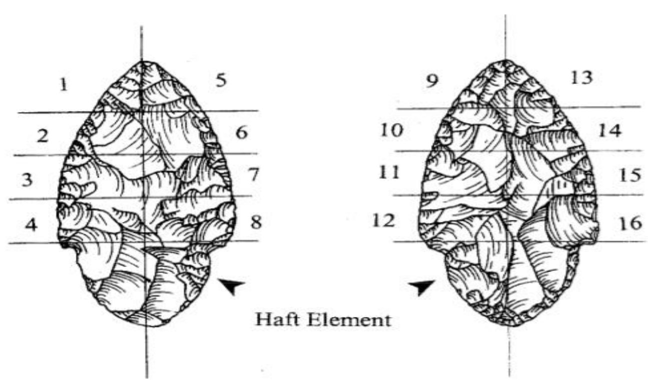

Figure 3.2 Hafted retouch index example (taken from Andrefsky 2006).

that higher-quality toolstone is expected to have a higher rate of retouch based on preferential treatment (Andrefsky 1994a). If higher-quality toolstone was preferentially used at these sites, the projectile points should demonstrate high rates of retouch due to resharpening. If higher-quality toolstone is not being preferentially treated, the HRI values of the projectile points should in general be similarly low.

Uniface Technology

Unifaces include those tools that exhibit modification with flaking on only one face. Unifacial technology identified in this analysis included flake tool types classified as denticulates, scrapers, core tools, choppers, and retouched flakes. Unifaces are identified by the patterns of retouch exhibited on the edges of the tools. A denticulate is a tool that has been flaked in a discontinuous pattern. Discontinuous edges exhibit retouch pattern of flake removals that are not directly beside one another, creating a saw-tooth pattern. A scraper exhibits flaking unifacially as well, but exhibits a steep (<50 degrees), invasive, continuously retouched edge. Continuous retouch refers to flake removals that are directly beside one another to form an edge. The edge modified (end, side) can vary on both types of artifacts. Both artifacts can vary considerably in size and form.

Core tools are modified stone tools made from the parent material of a core rather than a flake. This class included general core tools and choppers. Retouch patterns on edges were variable and edges were described in terms of continuous or discontinuous, invasive or non-invasive retouch, and edge angle. A chopper is as a large core tool that has been flaked unifacially, generally in an irregular pattern to create a coarse cutting or chopping edge. The identification of these tool classes and the edge patterns they exhibit helped address the standardization of tool form and design at the sites. It also helped address whether any specific raw materials were favored during tool use.

Retouched flakes are included as a tool type as they exhibit intentional edge modification. Attributes recorded for retouched flakes included condition, edge shape, edge angle, metric dimensions (length, width, thickness), platform, platform preparation, raw material, and the number of dorsal scars. The edge modification of a retouched flake can be either bimarginal or unimarginal.

Composite Flake Tool

A composite tool is a variable tool class that exhibits use as two different tool types and non-standardized flaking patterns (Sliva 2006). Attributes recorded for composite tools included metric dimensions, condition, the number of worked edges, and type of retouch on the edge (continuous vs. discontinuous, invasive vs. non-invasive), edge shape, and edge angle. Identification of composite tools helped assess how raw material may have affected tool design and form.

Core

Cores are nodules from which flakes were removed. Attributes recorded on cores included condition, raw material, percentage of cortex, number of flaked surfaces, number of flake scar removals, core type, and metric dimensions. Condition included complete or fragmentary. Metric dimensions were collected as maximum length with a width measurement perpendicular. Thickness was measured at its maximum dimensions.

Core types included tested piece, multidirectional, unidirectional, bidirectional, and exhausted. No bipolar cores were identified during this analysis. A tested core is a cobble piece that has had only one or two flake removal scars, most likely as an attempt to check the quality of the raw material or for an immediate need. A multidirectional core is one in which various platforms are evident on the cobble. Flakes have been removed in a random manner with little evidence of repeated platform use or preparation. A unidirectional core is the opposite, in which a core has evidence of use of a single platform plane. A bidirectional core is one in which flake removals occur as the result of two opposing platforms being used. This results in a uniformly thinned core. An exhausted core demonstrates many flake removal scars across its faces. It is generally small in size, due to the continued shrinkage of the parent material from flake removal. The diminishment of the raw material has created little or no opportunity to yield additional successful flake removals. Understanding the core type and how flake removal occurred on the parent raw material at these sites addressed the research question of raw material conservation and differential treatment of raw materials. If differential treatment of raw materials occurred, cores of specific raw materials should demonstrate different flake removal patterns or differing levels of use as a parent material.

Debitage

The analysis of debitage can provide data to understand the types of flintknapping activities occurring on-site. The debitage assemblages from each site were sampled from different units to provide information on patterns of the flake debris within different use-areas of the sites. Several excavated units were randomly selected and all debitage was analyzed from these units (see Table 3.1). These units overlaid different contexts including midden, habitation, and storage features. These debitage samples were not stratified by attribute (i.e. intact platform) or size class as seen in several studies (Bradbury 1998; Will 2000). Instead, all flakes were analyzed from the bags collected from these specific units and were not systematically pre-sorted beyond unit stratum and raw material.

The attributes recorded for debitage included: flake portion, platform type, platform metric dimensions, platform preparation, raw material, size class, percentage of cortex, and dorsal scar count (Table 3.3). Lipping on the platform was also recorded as it assisted in identifying to what degree soft-hammer percussion activities occurred at the sites.

Table 3.3 Debitage attributes, their definitions, and research question addressed.

Attribute	**Definition**	**Research Question Addressed**
Portion of Flake	COMPLETE = includes platform, termination, and two lateral edges PROXIMAL = includes platform but no termination DISTAL= includes flake termination, but no platform MEDIAL= includes two lateral edges but no platform or flake termination LATERAL= includes one side edge of a flake but no platform or termination SHATTER= angular debris from debitage FRAGMENT= indeterminate flake fragment which does not include any observable flake attributes	1, 2, 3
Raw Material	Chert, Chalcedony, Obsidian, Quartzite, Rhyolite, Diorite, Sandstone, Limestone, Basalt	2
Platform Type	PLAIN = exhibits no modification CORTICAL = retains cortical material from parent material CRUSHED= platform has been obliterated by percussive force SPLIT= only a portion of platform is intact COMPLEX= exhibits platform preparation	1, 3
Platform Preparation	Trimming, Grinding, Abrading, Faceting	2, 3
Size Class	Under 10 mm 10 to 20 mm 20 to 30 mm 30 to 40 mm Over 40 mm	1, 2
Metrics	Length; width; maximum thickness; weight (grams)	1
Dorsal Scar Count	0 1 to 2 3 to 4 5 to 6 6+	3
Cortex %	0 61 to 90 1 to 10 91 to 99 11 to 40 100 41 to 60 ABSENT/PRESENT	1, 2

Raw Material

Identification of raw material types assisted in understanding how the chipped stone assemblages were organized in regard to the conservation, investment, and preference for specific types of toolstone (Odell 1996). The Yamashita assemblages are currently curated at UNLV. The chipped stone was inventoried according to general tool types and raw material by students and volunteers. Raw materials identified by volunteers included various cryptocrystalline silicates of different colored and textured chert and chalcedony. Other raw materials included both fine-grained and coarse-grained basalt, quartzite, sandstone, rhyolite, limestone, diorite, and obsidian. During the course of this analysis, these raw materials were re-examined using literature addressing geological data of the local area (Gardner 1968).

Cryptocrystalline silicates are known to be found throughout the area in the form of small to medium-sized nodules found throughout the floodplain environment. Gardner (1968) additionally noted chert sources on Mormon Mesa, a large plateau approximately 8 kilometers from Sand Bench. Both of these sources are likely the origins for much the chert utilized during the Puebloan habitation of the Muddy River area. Quartzite and rhyolite nodules of varying sizes are also found on the floodplains in the area. Basalt and limestone account for a small percentage of the raw material used at the Yamashita sites. They can be found in the local gravels within the valley.

Site assemblages from nearby Puebloan sites suggest that many of the raw materials found in the assemblages are likely to have been available within local distance or semi-local distances of Sand Bench (Lyneis, personal communication, 2010). Adam-2 (26CK2059), a late Pueblo II period site, also located in the Moapa Valley, shares large quantities of cryptocrystalline silicates in its assemblage with 76% of debitage being chert, followed by quartzite at 12%, and other discussed toolstone not exceeding 5% each (Lyneis et al. 1989). Assemblages from the Lost City PII period settlements were also dominated by chert and at Bovine Bluff, an early PII site, debitage was mainly chert at 77% (Shutler 1961; Lyneis and Myhrer 1985). Obsidian was reported in these assemblages in small quantities and may have been imported or were collected locally as small nodules washed down into the Moapa Valley from the Kane Springs source (Allen 1999). Sourcing of obsidian at the Yamashita sites confirmed that Kane Springs was a common source. However, certain varieties of obsidian were unconfirmed to their source, suggesting obsidian sources still yet to be identified in southern Nevada.

Cryptocrystalline silicates include chert and chalcedony. Chert is a fine-grained sedimentary rock that is the most prevalent raw material in the Yamashita sites. It ranges in color and can vary from a high-luster, waxy texture to a more dulled color. Its flaking properties make it a preferred raw material for flintknapping. Chalcedony is also easily knappable. Chalcedony tends to have a color that ranges from white to gray and can be either transparent or opaque. Various inclusions in chalcedony in the assemblages impacted its knapping quality as demonstrated through manufacturing errors and high fracture rates along inclusions. Chert and chalcedony are the most common raw material in the area and were highly worked at VBP sites. Heat-treatment was possibly implemented on chert to improve the flaking mechanics of the toolstone, as exhibited by much of the material’s high luster. Heat-treating was not systematically noted during this analysis, however. Heat treatment however has been identified at VBP sites on the Shivwits Plateau (Wambach 2012).

Quartzite is metamorphosed sandstone. It is the second most common raw material seen at the Yamashita sites. Rhyolite is an igneous rock that takes a variety of colors, most commonly reddish or gray in the Yamashita assemblages. Phenocrysts of feldspar or quartz are generally highly visible in the material. Likely due to its difficulty in knapping, it is restricted to specific tool types in the Yamashita sites - retouched flakes and heavier core tools. Limestone is also not seen in large quantities in the assemblages. Limestone is a hard sedimentary rock. Limestone in the assemblages is gray in tone, fossil-rich, and is used for heavier chipped core tools. These limestone tools tend to have sharp, jagged cutting edges.

Additional raw materials in the assemblages include sandstone and basalt, but in small quantities. Sandstone is a sedimentary rock composed of sand-size grains, usually dominated by quartz. It is rare in the assemblages and restricted primarily to large decortication flakes or groundstone. For instance, research on the groundstone of the Yamashita sites identified 57% and 68% of the groundstone at Yamashita-2 and Yamashita-3 as sandstone (Falvey and Menocal n.d.). Basalt is an igneous rock that is generally black to gray in color. It varies from fine-grained to coarse-grained specimens. It is limited to early-stage decortication flakes in the chipped stone assemblages.

Obsidian is a natural volcanic glass that is usually black in color, but can also have other colors. It is a favored raw material as it has predictable flaking properties. It was often traded across distances in prehistoric times. The obsidian seen in these assemblages is generally very dark in color with few inclusions. This toolstone tends to exhibit well-developed conchoidal fractures and is used for various cutting and projectile activities. Obsidian has distinct chemical compositions that allow for the identification of its source. Much like other sites in the area, it accounts for a small percentage of the Yamashita sites' chipped stone assemblages. Seventeen obsidian artifacts were sourced from the sites: ten from Yamashita-2; five from Yamashita-3; and two from Yamashita-5S (see Chapter 5).

Summary

This chapter outlines the methods used in this analysis. The attributes discussed above allowed for the collection of data that provided information regarding the research questions concerning raw material acquisition and availability, occupation duration, and tool design and form related to the chipped stone assemblages found at the Yamashita sites. The results of this analysis are presented in the following chapter.

CHAPTER 4

YAMASHITA SITES: RESULTS

This chapter presents the results of the analysis of the chipped stone assemblages from each site and includes a discussion of bifaces, unifaces, core tools, cores, and debitage. Site comparisons and interpretations are provided in Chapter 5.

Yamashita-2 (26CK6445)

The Yamashita-2 tool and debitage assemblage consists of 340 stone tools (Table 4.1), 19 cores, 2 tested cobbles, and 806 pieces of debitage. Yamashita-2 had four PII structures, two of which were habitation rooms: Structure 1 and Structure 4.

Table 4.1 Chipped stone tool assemblage from Yamashita-2.

Tool Type	Sub-Type	Count	Percent of Tool Type
Projectile Point	Desert Side-Notched	21	24
	Cottonwood	14	16
	Rosegate	11	12
	Parowan Basal-Notched	5	6
	Dart point	3	3
	Not assigned	34	39
SUBTOTAL		**88**	**100**
Other Biface	Unhafted Biface	175	91
	Drill	16	8
	Knife	2	1
SUBTOTAL		**193**	**100**
Composite	Composite Tool	1	100
SUBTOTAL		1	**100**
Uniface	Scraper	6	13
	Denticulate	2	5
	Retouched Flake	36	82
SUBTOTAL		**44**	**100**
Core Tool	Chopper	1	7
	Generalized	13	93
SUBTOTAL		**14**	**100**
GRAND TOTAL		340	100

Attached to Structure 1 was a set of store rooms. Attached to Structure 4 was a store room to the west, designated Structure 2, and a store room to its south, designated Structure 3. Sheet trash was spread around the site, to the west and to the southeast of the structures. Trash was most dense to the southeast. None of the chipped stone tools were found on the floors of any of the structures. Artifacts were recovered predominantly from sheet trash, but were also found in habitation and storage room fill.

Projectile Points

Eighty-eight projectile points were recovered from Yamashita-2, accounting for 26% of the site assemblage. Of this count, 54 points were identified to type. The remaining 34 points were not typed because they were not diagnostic or were fragmentary sections. No distal ends were considered in this count and distal ends were classified as unhafted bifaces.

The majority of typed points recovered from Yamashita-2 were Desert Side-Notched (DSN) (n=21; 24%) (Figure 4.1). DSN points enter the archaeological record approximately AD 1100 to 1200, dating slightly later than the site (Justice 2002). The average length of these points is 21.6 mm with a range of 15.5 to 29.5 mm. The average width of these points was 13.1 mm; the average thickness 2.6 mm; and the average weight 0.5 grams. Across the site, 11 of the recovered DSN points were complete. The remaining points were nearly complete (n=7) or were basal fragments (n=3). Two of these points were made of obsidian and the rest (n=19) were made of CCS. Fourteen of these DSN points were recovered from the sheet trash to the west of the site's structures. None were recovered from the sheet trash to the southeast. Three of these points were recovered from the structures on the north end of the site: two complete points from the habitation room of Structure 4 and one nearly complete point on the west end of the store rooms associated with Structure 2. One of the points associated with the habitation room of Structure 4 was recovered near the eastern wall alongside charcoal and fire-cracked rock. The other point was recovered from a looter's pit. The final four points were recovered in or near Structure 1.

Figure 4.1 Yamashita-2 Desert Side-Notched projectile point examples.

Cottonwood points were the second most common point at the site (n=14; 16%) (Figure 4.2). Cottonwood projectile points are small un-notched triangular arrow points. The type enters the archaeological record in the area at approximately AD 900 and its use persisted until the historic period (Justice 2002). The average length of these points is 19.0 mm with a range of 14.8 to 24.5 mm. The average width of these points was 12.7 mm; the average thickness 3.0 mm; and the average weight 0.7 grams. Of the fourteen recovered Cottonwood projectile points, seven Cottonwoods were complete or nearly complete. The remaining seven were basal fragments. One of the complete points was made of chalcedony; the rest (n=13) were made of chert. Eleven of these Cottonwood projectile points were recovered from trash fill across the site, primarily from the sheet trash to the west of the structures. Three of the points were found within the site's structures. Two points from Structure 1 were recovered from the fill of a habitation room and an attached storeroom and one near-complete point was found in the habitation room fill of Structure 4.

Figure 4.2 Yamashita-2 Cottonwood Triangular projectile point examples.

Eleven points from Yamashita-2 were Rosegate (12% of the projectile points) (Figure 4.3). Rosegate series is a composite cluster consisting of Eastgate Expanding Stem and Rose Springs Corner-Notched projectile points. Rosegate series is often noted to be used in the area before the introduction of Cottonwood and Desert Side-Notched points. The type appears around AD 750 (Justice 2002). These arrow points are primarily distinguished by their corner notching and narrow necks. The average length of these points is 27.7 mm with a range of 21.8 to 33.9 mm. The average width of these points was 17.0 mm; the average thickness 4.1 mm; and the average weight 1.8 grams. Three of the eleven recovered Rosegate points were complete. The remaining points were in near-complete condition (n=3) or were basal fragments (n=5). All of the basal fragments broke through snap fractures rather than manufacturing errors, suggesting point repair and retrieval of point fragments for potential reuse. One base was made of obsidian and the rest (n=10) of the points were made of chert. Four of these points were recovered from the trash fill to the southeast of the structures. No Rosegate points were recovered from the sheet trash area on the west side of the site, possibly suggesting different use of trash areas during occupation. One point was recovered near Structure 1 in gray rubble. One base was recovered from the storeroom of Structure 1, one from the storeroom fill of Structure 2, and one from storeroom fill of Structure 3. Two were recovered from the habitation room fill of Structure 4. Both had been reworked and were possibly heat-treated. One additional base was located between this structure and Structure 4.

Figure 4.3 Yamashita-2 Rosegate projectile point examples.

Five chert Parowan Basal-Notched points were recorded (6% of the projectile points) (Figure 4.4). Parowan Basal-Notched points are often classified under the Rosegate series of projectile points due to their technological and morphological similarities (Justice 2002). Yet, as the Parowan series is generally considered to be more commonly noted at Fremont sites dated to AD 950–1200 (Holmer and Weder 1980: 64), these point types were separated. Parowan as a point type can vary in blade length, but generally exhibit an elongated triangular blade and shallow basal notching beside their stems. The presence of Rosegate and Parowan points across the sites was expected given the concurrent use of these points throughout VBP occupations (see Chapter 5) (Justice 2002). The average length of these points was 29.6 mm with a range of 23.7 to 33.6 mm. The average width of these points was 17.4 mm; the average thickness 3.6 mm; and the average weight 1.4 grams. Three of the projectile points were complete or near-complete, one was a midsection, and the other one was missing its base. All were made from chert. One point recovered from the southeast trash fill. Two Parowan points were associated with Structure 1 and were found in adobe layers: one nearly complete point recovered from the habitation room fill and another recovered from a store room in Structure 1. Another Parowan point was nearly complete and found in the fill of store room of Structure 3. The final Parowan point was a medial section and was recovered from the fill of the habitation room in Structure 4.

Figure 4.4 Yamashita-2 Parowan Basal-Notched projectile point examples.

Two points were side-notched dart points (Figure 4.5). One was a high-luster brown chert base. A snap fracture was evident across its blade and it was recovered near a store room at Structure 1. A second point was also another base. Its notching was similar to the other point and was made of a dull gray-colored chert. It was recovered at a depth of 120 to 130 cm near the southwestern portion of the site and was possibly associated with one of the Basketmaker cists on the sand bench, given its depth and proximity to a cist. No length dimensions were obtained for the points. Both points were similar in metric dimensions in regard to maximum width (21.7mm; 22.19mm) and stem width (19.51mm; 19.96mm), yet the first point had thicker dimensions (4.96mm; 4.91mm). One additional basal fragment was likely also a dart point, but remained unclassified: half of a red chert base, found in trash fill.

Figure 4.5 Yamashita-2 Side-Notched dart points.

Four additional projectile points were classified as heavily reworked points as the level of reworking had significantly altered their morphological features. All were complete or nearly complete. Reworking tends to occur to extend the use-life of a tool, particularly in toolstone-poor environments. Only one of the points was made of obsidian, the other three were made of chert, a local and available raw material, suggesting that reworking of these points was not specifically tied to a perceived high risk of toolstone rarity. Two were recovered from trash fill. One point was recovered during backfill near Structure 3. The last reworked point also may have originally been a Rosegate point and was recovered in the habitation room fill of Structure 3.

One complete arrow point was classified in this analysis as an eccentric point. It did not fall within any of the dimensions of any series. It was morphologically similar to another point from the region, identified as possible Lower Colorado from Bovine Bluff (Lyneis and Myhrer 1985: 49). It was a fine-grained white chert point, flaked in a horizontal pattern with a relatively flat cross-section. It had a wide serration pattern along its edges and a convex base. The tip of this specimen was broken off. Few flake removals stretched to the center of the blade of the point and a median ridge was still visible on the point. It was recovered from trash fill. The remaining projectile point assemblage consisted of fragmentary non-diagnostic sections of points (n=29; 33%).

Unhafted Bifaces

A total of 175 unhafted bifaces were recovered from the site, accounting for 51% of the site assemblage (Table 4.2). Over 90% of the bifaces (n=159) were CCS; the majority of which were chert (n=153; 87%). Other raw materials included obsidian (n=11), quartzite (n=1), rhyolite (n=3), and limestone (n=1). The majority of these bifaces were recovered from the trash contexts (n=81; 46%). Twenty three (13%) were from the store room fill of Structure 1 and 24 (14%) were associated with Structure 1. Eight (5%) were recovered from the storeroom of Structure 2. Nineteen (11%) were recovered from store fill of Structure 3 and 20 (11%) from the habitation fill of Structure 4.

The five-stage model of biface production (Andrefsky 2005) used in this analysis shows that the greatest proportion of bifaces in this category are finished bifaces (n=79;

45%). The few complete bifaces in the assemblages (n=17) were Stage 2 edged bifaces or Stage 3 thinned bifaces, 15 of which were made of chert. Of the incomplete bifaces, the greatest number (n=73; 41%) were distal ends. A majority (n=55; 31%) of the distal ends were in late stages as Stage 4 preforms or Stage 5 finished forms. Their breaks were the result of use-impacts indicative of hunting activity and retrieval of these fragments at the site instead of off-site**.** The average length of these bifaces was 28.8 mm; the average width 18.7 mm; the average thickness 5.9 mm; the average weight 3.9 grams.

Table 4.2 Yamashita-2 biface stages by provenience.

Provenience	**BIF I**	**BIF II**	**BIF III**	**BIF IV**	**BIF V**	**IND**	**TOTAL (%)**
Structure I, Habitation	0	1	3	4	1	0	**9 (5%)**
Structure I, Store Rooms	1	8	2	2	8	2	**23 (13%)**
Near Structure I	0	5	3	4	3	0	**15 (9%)**
Structure II, Store Rooms	0	1	1	1	5	0	**8 (5%)**
Structure III, Store Room	0	1	2	3	13	0	**19 (11%)**
Structure IV, Habitation	0	1	5	3	9	2	**20 (11%)**
Trash Fill (SE portion of site)	1	6	5	3	19	5	**39 (22%)**
Trash (SW portion of site)	0	2	2	2	5	0	**11 (6%)**
Trash (W portion of site)	0	6	3	2	16	4	**31 (18%)**
TOTAL (%)	**2 (1%)**	**31 (18%)**	**26 (15%)**	**24 (13%)**	**79 (45%)**	**13 (8%)**	**175 (100%)**

Knives

One knife base fragment and one knife tip were recovered (less than 1% of the site assemblage) (Figure 4.6). Both were made of chert. The basal fragment expanded outward and had a convex curvature. It had been finely pressure retouched along both intact lateral margins and its base and it was broken by a lateral snap. Several small step fractures were visible along both faces, which may have been due to the quality of the toolstone. The knife tip was manufactured on a brown chert and had a visibly blunted point as a result of use. Both were recovered from trash fill.

Figure 4.6 Yamashita-2 knives.

Drills

Sixteen drills were recovered, eight of which were complete or nearly complete, accounting for 5% of the assemblage (Figure 4.7). The other eight were drill tips. All but one of these drills were made from chert; one complete drill was made of rhyolite. Three of these drills were manufactured on Rosegate and Parowan point bases. Other drills were straight based (n=1) or T-shaped base (n=4). The drills with intact drill bit tips exhibited both rounded and diamond-shaped designs. The diamond-shaped tips remained relatively sharp, while many of the rounded bits had been blunted from possible use. Four of these drills were recovered from Structure 1 store room fill and three from its habitation room, possibly suggesting association with household activities. Two drills were found in store rooms in Structure 2, and two from the habitation room of Structure 4. Four others were recovered from trash fill. The last drill was recovered from the surface on the southeast end of the site.

Figure 4.7 Yamashita-2 drill examples.

Composite tool

One complete composite tool was identified at the site (less than 1% of the assemblage). It was a small rhyolite composite tool with superimposed flake removals on its end, creating a modified edge measuring 29.81 mm. A second edge showed flake removals and utilization and the edge measured 20.46 mm. It was found in the trash fill to the southeast.

Unifaces

The tool assemblage consisted of 39 unifaces: 36 retouched flakes, 6 scrapers, and 2 denticulates, accounting for 11% of the chipped stone. Artifacts were only considered retouched flakes if small flake removals on the edges were continuous, definitively cultural in origin and were deemed intentional. Most of the retouched flakes were fragmentary and made of chert except for two retouched flakes made of obsidian. The majority of these flakes exhibited no cortex (n=26; 72%). These flakes had been retouched along one of their edges, with the exception of three flakes that exhibited bimarginal retouch. Fourteen of these retouched flakes were recovered from midden contexts and the majority (n=12; 86%) were fragmentary. The others (n=22) were taken from the various structures.

Six complete scrapers were recovered. All but one was made from cryptocrystalline silicates, four of which were chert and one of chalcedony. An additional scraper was made of quartzite. Two complete scrapers were recovered from the same level of Structure 2's store room fill. One of these scrapers was made of chalcedony. The other scraper was made of chert. A third scraper was found in the trash fill on the southeast section of the site. Another scraper was found to the west of Structure 3. The last two scrapers were found to the south of Structure 4's habitation room. Two denticulates were recovered. The denticulates were made from CCS and were recovered near the store room of Structure 1. The other denticulate was fragmentary and was recovered in the trash fill on the southeast side. Except for two of the scrapers, all scrapers and denticulates had a convex edge shape.

Core Tools

Fourteen core tools were recovered: one chopper and thirteen other core tools (5% of the chipped stone). The only chopper from the site was made of a tan quartzite. It was unifacially flaked with a sharp modified edge. It had evidence of use as a hammerstone with light battering rounding off one of its edges. It was recovered from a unit near Structure 1's store room.

Eleven of the 13 other core tools were complete (85%). Five of these core tools were made of limestone, four of rhyolite, two of quartzite, and one of chert and of sandstone. Seven of them exhibited unifacial flaking. The other six had bifacial flaking. Nine of them had convex edge shapes; the other four had a straight edge shape. All had steep edge angles. Three of the core tools had some evidence of battering, indicating use as heavy-implement tools. The core tools did not demonstrate any consistent standardized flaking pattern, suggesting expedient design within this tool class. As chopping and pounding implements, modification to their ends to create a sharp edge appeared to suffice to accomplish activities. Seven of the core tools were found in trash fill. Five were found in association with Structure 1's habitation room, suggesting that heavy implement were stored or that chopping activities occurred in this room. The last core tool was recovered from the habitation room in Structure 4.

Cores

Nineteen cores were found at Yamashita-2, which was a very small number of cores. All but four of the cores were fragments (n=15; 79%). The majority of these cores (n=12; 63%) were made of chert. The remaining specimens included three obsidian, two quartzite, one limestone, and one rhyolite core. The majority (n=12) of the chert cores were fragmentary (n=7; 58%). Only one complete chert core was exhausted. All of the cores of this raw material had less than half of their rind intact and flake removals ranging from five to twenty flake scar removals. All of these cores exhibited a multidirectional flake removal pattern with little to no platform preparation on the artifacts. Complete chert cores averaged in length 22.7 mm; in width 17.5 mm; in thickness 12.9 mm; and weight 7.4 grams.

The three obsidian cores were small, with little to no cortex. One was complete and had two flaked faces and fifteen flake removals. The other obsidian specimens were core fragments with multiple flake removals. The two quartzite cores were both complete and large in size. They had less than half of their cortex, but were not as heavily reduced as the other cores, with fewer than six flake removals each. Both the rhyolite and limestone cores were fragmentary pieces. They were also not as heavily reduced with fewer than five removals each. Eleven of these cores were recovered from trash fill. Seven of the chert cores were recovered in Structure 1 store room fill and one was recovered from Structure 3 store room fill. The core data suggests expedient use of cores and little conservation of chert, quartzite, and limestone. The small size of the obsidian may suggest more conservation of this toolstone or it may reflect small initial nodule size.

Tested Pieces

Tested pieces exhibited little modification which was interpreted as limited flake removal to determine the quality of the raw material. Two complete limestone tested pieces were identified in the assemblage. One was recovered from Structure 1 habitation room fill and the other from sheet trash. These pieces may have been modified to determine if they were suitable to use as heavy-use implements, given limestone's use in the core tool class.

Debitage

The Yamashita-2 assemblage was sampled from trash contexts on the southeast end of the site because that area had the heaviest concentration of artifacts. The sample consisted of 806 pieces of debitage. Raw material noted in the debitage included chert and chalcedony (n= 576), quartzite (n=147), rhyolite (n=22), sandstone (n=2), limestone (n=19), basalt (n=4), and obsidian (n=36). Flake fragments (n=334) held the greatest proportion of the assemblage (44%), while complete (n=123) and proximal (n=139) flakes accounted for 32% collectively (Table 4.3). Microflakes (n=156, 20%) were considered flakes smaller than 0.5 millimeters and took up a sizeable proportion of the debitage sample.

Table 4.3 Yamashita-2 debitage dataclass.

Flake Type	Count	Percent
Complete	123	15
Flake Fragment	356	44
Proximal	139	17
Debris	32	4
Microflake	156	20
TOTAL	**806**	**100**

Platforms recorded on complete and proximal flakes were dominated by plain platforms (n=114; 43%), followed by crushed or absent platforms (n=86; 33%) (Table 4.4). Cortical platforms were the least common platform type (n=30; 12%). Platform preparation was noted on approximately 16% of the assemblage (n=43) and corresponded heavily with faceted platforms (n=32; 12%) in the form of trimming and grinding. Lipping was noted in 18% of the complete and proximal flakes (n=46), while very little splitting was recorded, occurring on 35 flakes (12%) from the assemblage.

Of the 123 complete flakes, the majority (n=86; 70%) had no cortex. Only 17% of the complete flakes (n=21) had greater than half of their cortex intact. Additionally, 75% (n=511) of the fragmentary flakes had no cortex on their dorsal sides. These data suggest that early-stage reduction was not a focus of chipped stone production at the site and the high percentage of microflakes (n=156; 20%) suggests that retouching was a regular activity at the site. However, it was unusual that faceted platforms were not as common as plain platforms that that platform preparation did not occur on a great proportion of the flakes.

Dorsal flake scar count also was collected. More dorsal flake scars generally indicate that the flake was removed from parent material later in the reduction sequence (Shott 1994). A majority of the complete flakes had two to four dorsal flake scars (n=82; 67%). Only 11 flakes (9%) had no flake scars on their dorsal side. These data lend support to later-stage reduction activities at the site.

Table 4.4 Yamashita-2 platform type (of complete and proximal flakes).

Platform Type	Count	Percent
Plain	114	44
Cortical	30	11
Crushed / Absent	86	33
Faceted	32	12
TOTAL	**262**	**100**

Size class can also be an indicator of reduction strategies (Table 4.5). Grouping the flakes into size classes showed that the majority (n=97; 79%) of complete flakes were less than 20 mm in length. These figures additionally suggest that late-stage reduction strategies were occurring at the site and that retouching, likely from tool maintenance and repair, was a routine practice.

Table 4.5 Yamashita-2 size class of complete flakes.

Size Class (in mm)	Count	Percent
Under 10	52	42
10 to 20	45	37
20 to 40	22	3
Over 40	4	18
TOTAL	**123**	**100**

Differences in raw material use were also shown through debitage size. Of the 84 complete chert flakes, 49% (n=41) were less than 10 mm, followed by 33% (n=28) that measured between 10 mm and 20 mm. Only one chert flake was recorded as measuring greater than 40 mm. The majority of obsidian flakes also measured under 10 mm. The coarser-grained materials, i.e. rhyolite, quartzite, and limestone, occurred in greater quantities in size classes between 20 and 40 millimeters. This suggested that late-stage reduction strategies were focused primarily on chert and obsidian. This may also had been affected by the size of the chert and obsidian nodules utilized on the site, which are generally smaller in size than the limestone, quartzite, and rhyolite raw material in the area and affected debitage size.

Summary

The disproportionate rate of biface technology was unusual at Yamashita-2. As Yamashita-2 is a PII site, the high proportion of unhafted bifaces (n=175; 51%) and projectile points (n=88; 25%) was unexpected as the site was sedentary. Additionally, as abundant raw material was nearby, it is unusual that these tool types dominated the assemblage given that expedient technology usually increases in such circumstances

(Parry and Kelly 1987). While it is possible that these numbers may be a reflection of recovery bias in the field, with regard to site function, the heavy emphasis on bifaces likely reflects that biface production, maintenance, and repair were the most common activities at the site, suggesting that hunting technology was being produced and that cutting and scraping activities routinely occurred at the site. The large number of bifaces at the site in comparison to other tools at the site may indicate that the biface tool was used as a general purpose cutting tool for plant processing. Other tools including drills, unifaces, and core tools demonstrated that other activities occurred at the site, but at much smaller frequencies. Boring activities, as well as chopping activities, possibly for hide processing and additional plant processing occurred at Yamashita-2.

Nearby abundant raw material was reflected in the chipped stone assemblage. A large proportion (n=309; 91%) of the chipped stone tools was made of CCS. The core and debitage data also indicated a focus on CCS, accounting for 12 cores (57%) and 71% (n=576) of the debitage sample. With regard to core reduction strategies, the core and debitage data suggested some level of core-reduction at the site. Initial core reduction was not heavily emphasized, as seen through the small number of cores and the low number of primary and secondary flakes compared to the large percentage of cortex-free tertiary flakes in the assemblage. The low rate of raw material conservation was odd given the technological focus on the production of maintainable biface technology. Biface technology is generally associated with a higher rate of raw material conservation. However, at Yamashita-2, raw material conservation at the site did not occur at a great rate as illustrated by the majority of cores exhibiting multi-directional flake removal patterns and a lack of preparation on debitage flakes. The lack of raw material conservation is likely due to the abundant raw material nearby. The preference for biface technology and a minimal presence of expedient technology is, however, in contradiction to this raw material use strategy.

Yamashita-3 (26CK6446)

The Yamashita-3 tool and debitage assemblage consisted of 241 stone tools, 19 cores, and 2,080 pieces of debitage (Table 4.6). Yamashita-3 had two set of structures: Structure 1 to the north and Structure 2 to the south. Structure 1 is a classic PII unit, which opened to the south to a courtyard. A habitation room was on either end of a connected curve of storage rooms. Another large room (Room A) on the eastern end of the roomblock attached to the habitation room. Structure 2 on the southern portion of the site is a line of storage rooms that may have acted as reach-in store bins. Artifacts were recovered from the fill of both structures as well as the courtyard.

Table 4.6 Chipped stone tool assemblage from Yamashita-3.

Tool Type	**Sub-Type**	**Count**	**Percent of Tool Type**
Projectile Point	Desert Side-Notched	19	25
	Cottonwood Triangular	18	24
	Rosegate	18	24
	Parowan Basal-Notched	3	4
	Dart point	2	3
	Not assigned	16	20
SUBTOTAL		**76**	**100**
Other Biface	Unhafted Biface	117	92
	Drill	3	2
	Knife	7	6
SUBTOTAL		127	**100**
Uniface	Scraper	1	3
	Retouched Flake	28	97
SUBTOTAL		**29**	**100**
Core Tool	Chopper	3	25
	Scraper	4	33
	Generalized	5	42
SUBTOTAL		12	**100**
GRAND TOTAL		**241**	**--**

Projectile Points

Seventy-six projectile points were analyzed from the assemblage, accounting for 31% of the chipped stone assemblage. Of this count, sixty-two were identified to type. The remaining 14 points were not typed because they were undiagnostic medial or fragmentary pieces. No distal ends were considered in these counts.

The majority of points recovered from the site were DSN (n=19; 25%) (Figure 4.8). The average length of these points was 22.8 mm with a range of 15.5 to 29.5 mm. The average width of these points was 13.1 mm; the average thickness 2.6 mm; and the average weight 0.5 grams. Fourteen were complete or nearly complete and five were bases. Three of the DSN points are made of obsidian; the other 16 were made of chert. Two of the points were found in Room A on the east end of Structure 1. Three were found in storeroom fill of Structure 1. Five were found in the courtyard. Five were found in the fill of the store bins of Structure 2. Two were found in sheet trash around the site and the last four were found on the surface of the site.

Figure 4.8 Yamashita-3 Desert Side-Notched projectile point examples.

Eighteen Cottonwood points were recovered and accounted for 24% of the projectile points (Figure 4.9). The average length of the points was 17.7 mm with a range of 11.95 mm to 26.63 mm; the average maximum width 10.9 mm; the average thickness 2.8 mm; the average weight 0.8 grams. Fourteen were complete or nearly complete and four were bases. Two of these points were made of obsidian and one was made from chalcedony; the rest (n=15) were made from CCS. Nine were recovered from the store bins of Structure 1. One was found on the surface. Four were recovered from the various store rooms of Structure 1. Two were recovered from the courtyard. Two recovered from the fill of the habitation room on the west end of Structure 1.

Figure 4.9 Yamashita-3 Cottonwood Triangular projectile point examples.

Eighteen points were typed as Rosegate (Figure 4.10) accounting for the same percentage as Cottonwoods (24%). The average length of these points was 30.7 mm with a range of 26.6 and 41.0 mm. The average width of these points was 16.7 mm; the average thickness 3.7 mm; and the average weight 1.2 grams. Six of the points were complete or nearly complete points and twelve were bases. The majority of the Rosegate basal fragments (n=10) had been broken by snap fractures on their blades, suggesting breakage during use. Only two of these bases showed manufacturing breaks. Two of these basal fragments show reworking on their stems and the barbs. Two complete points have had their tips resharpened. Only one point was made of obsidian and the others (n=17) were made of chert. The majority of the Rosegate points were associated with the courtyard unit to the north: seven in the courtyard itself; two in the fill of the west habitation room; three in store room fill; and two from the fill of Room A. Two were found in the sheet trash around the site. One point was found on the surface. Only one Rosegate point was recovered from the store bins of Structure 2.

Figure 4.10 Yamashita-3 Rosegate projectile point examples.

Two complete Parowan arrow points and one midsection were recovered, accounting for 4% of the projectile point counts (Figure 4.11). The complete points were similar in morphology, dimensions, and design. Both had long, isosceles triangular blades and had their stems reworked in a similar manner with a deep basal notch intact on one side and a horizontal shoulder on the opposite side, perhaps suggesting a single manufacturer for both points. All Parowan points were made of chert. One was found on the surface of the site and the two others were found on the west end of the courtyard unit in habitation room fill.

Figure 4.11 Yamashita-3 Parowan Basal-Notched projectile points.

Two complete points were dart points (Figure 4.12). One point was side-notched and made of mottled brown chert. The other was stemmed and made of quartzite. These dart points were possibly collected prehistorically and, given their intact condition, were likely not used for hunting. One was found in the store bins to the south and one in the store rooms of the northern courtyard unit. The remaining projectile point assemblages consisted of fragmentary or non-diagnostic sections of points (n=16; 20%).

Figure 4.12 Yamashita-3 dart points.

Unhafted Bifaces

A total of 117 unhafted bifaces were analyzed from Yamashita-3, accounting for 48% of the overall assemblage (Table 4.7). The bifaces were primarily made of chert (n=105; 90%), with lesser quantities of chalcedony (n=6; 5%), obsidian (n=4; 3%), and quartzite (n=2; 2%).

The majority of these bifaces were recovered from the trash contexts in the courtyard (n=45; 39%). Twenty nine (28%) were from the reach-in store bins on the south end of the site, followed by 17 (15%) in the storeroom arc of the courtyard unit. Room A on the east end of the courtyard unit had 10 bifaces (9%). Room B had 5 unhafted bifaces (4%) and the habitation room on the far west end of the courtyard unit had 11 (9%).

The five-stage model of biface production used in this analysis (Andrefsky 2008), showed that the greatest proportion of bifaces were finished bifaces (n=65; 56%). The few complete bifaces in the assemblages (n=3; 2%) were made of chert and were Stage 2 edged bifaces and Stage 3 thinned bifaces. All three were recovered from Structure 2, the unused reach-in storage bins on the south end of the site. Their sizes were comparable and they had an average length of 22.6 mm; average width of 18.9 mm; thickness of 5.6 mm; and weight of 2.35 grams. Of the incomplete bifaces, the greatest number (n=55; 47%) were distal ends. A majority (n=51; 92%) of the distal ends were in finished form and their breaks were the result of use-impacts indicative of hunting activity and retrieval of these fragments at the site instead of off-site. Over 81% (n=45) of the distal ends were chert, with lesser quantities of obsidian (n=4), chalcedony (n=4), and quartzite (n=2).

Table 4.7 Yamashita-3 biface stages by provenience.

Provenience	**BIF I**	**BIF II**	**BIF III**	**BIF IV**	**BIF V**	**IND**	**TOTAL**
Structure 1, Room A	0	4	1	1	3	1	**10 (9%)**
Structure 1, Room B – Habitation	0	1	1	0	3	0	**5 (4%)**
Structure 1, Rooms C – H – Store Rooms	0	1	3	3	10	0	**17 (15%)**
Structure 1, Room I – Habitation Room	0	0	3	1	7	0	**11 (9%)**
Courtyard	0	4	8	2	27	4	**45 (38%)**
Structure 2, Store Rooms	1	5	6	1	15	1	**29 (25%)**
TOTAL (%)	**1 (1%)**	**15 (13%)**	**22 (19%)**	**8 (7%)**	**65 (56%)**	**6 (5%)**	**117 (100%)**

Knives

One complete knife, three basal fragments, two medial fragments, and one knife tip were recovered from excavations, accounting for 3% of the site assemblage (Figure 4.13). All of the artifacts were made of chert and were lenticular in cross-section.

Figure 4.13 Yamashita-3 knife examples.

The complete knife was a black-mottled white low-quality chert knife. It had been extensively retouched along both its lateral edges and along its base with evidence of hafting. It had a relatively flat cross-section and its base flared outward, giving it a triangular shape. The knives demonstrated several breaks and fractures as the result of inclusions in the raw material. This was likely due to the level of retouching and thinning and the quality of the chert used. The chert quality was variable and imperfections in the toolstone were common. Two of the knives were recovered from room fill from the western habitation room; one near the east wall of the western habitation room; one in the courtyard; one from Room A; one from storeroom fill from Room B on the east end.

Drills

Drills from Yamashita-3 included one complete artifact and two drill bits, accounting for 1% of the assemblage. The complete drill was composed of a coarse-grained red quartzite. It had a T-shaped base and a rounded bit. The remaining drill tips were composed of chert. One was smaller in size and had a diamond bit. The other bit was considerably thicker and had a diamond-shaped cross-section. The complete drill was recovered from the courtyard; the bits from Room A and store bins on the south end of the site. The few drills recovered show that boring activities occurred enough to necessitate a specialized tool form, but that these activities did not occur as often as others.

Unifaces

The assemblage consisted of 28 retouched flakes and one scraper, accounting for 12% of the site assemblage. Of the 28 retouched flakes, 9 (32%) were complete. Two flakes were made of obsidian; the rest (n=26) were chert. Twenty of these flakes (71%) had no cortex on their dorsal side. Only one flake from the assemblage had greater than 50% cortex. Eleven (39%) of the retouched flakes had bimarginal retouch. The only scraper was complete and made of a gray chert. It exhibited approximately 10% cortex on its dorsal side, suggestive of a cortex backing. It had one edge of continuous retouch and a convex edge shape. The presence of retouched flakes in the chipped stone assemblage reflected at least some expedient tool use at the site, although formal technology was proportionally larger. The use of these retouched flakes likely reflected opportunistic use of suitable cutting edges for quick tasks. The small number of them in the assemblages demonstrated that expedient use was not favored, however.

Core Tools

Core tools consisted of three complete choppers and nine other core tools, accounting for 5% of the site assemblage. Two choppers were made of limestone and one was made of rhyolite. Two of these choppers exhibited light battering on the opposite ends of their flaked edges. Both of the limestone choppers were found in the habitation room on the west end of Structure 1. The rhyolite chopper was found in Structure 2. Nine other core tools were recovered: four scraper core tools and five additional core tools. Three of the scraper core tools were made of limestone and one was made of quartzite. All of the scraper core tools had convex edge angles. The quartzite scraper core tool had evidence of battering on its opposite end. Two of the limestone scrapers were found in or near the habitation room on the east end of Structure 1. The additional limestone scraper was found on the east end of Structure 1. The quartzite scraper was found on the east end of Structure 2. The five other core tools had non-uniform flaking patterns. Three of these core tools were made of chert, while two were made of limestone. All had steep angles. One was bifacially flaked and the others were unifacially flaked. Two of these chert core tools had evidence of battering on the other ends. One had evidence of burning. The non-standardization of core tools suggested that chopping and pounding activities did not necessitate specific tool forms beyond that of a heavy tool implement with a sharp, durable cutting edge.

Cores

Nineteen cores were identified from Yamashita-3, which was similarly low in number to Yamashita-2. Nine of the chert cores are complete, of which 4 were exhausted.

Chert was the dominant toolstone (n=14; 74%), followed in lesser quantities by coarser-grained raw materials of limestone (n=2; 11%), quartzite (n=2; 11%), and rhyolite (n=1; 4%). The five other cores had variable amount of use ranging in flake scars from two to seven removals. The measurements of these complete chert cores averaged in length 38.05 mm; in width 31.19 mm; in thickness 17.45 mm; in weight 25.96 grams. All of these cores exhibited a multidirectional pattern of flake removal with little to no platform preparation evidence. Three of the cores had undergone heat-treatment. Only one core demonstrated any secondary use with evidence of use as a hammering implement. The remaining cores made of other toolstone had several flake removals taken from each core, but none were as heavily utilized as the chert cores with no more than 4 flake removals each. The rhyolite and quartzite cores were fragmentary. The small number of cores at the site reflected that initial core reduction probably occurred off-site, but that at least some later core reduction was on-site.

Tested Pieces

Three tested pieces were recovered. They were all complete; two were made of limestone and one of rhyolite. One of the limestone pieces showed evidence of light battering. Both limestone tested pieces were recovered from the habitation room on the west end of Structure 1. The rhyolite piece was recovered near the store bins on the south end. Like the coarser-grained tested pieces at Yamashita-2, these pieces probably reflected testing for use as a heavy core tool implement.

Debitage

The Yamashita-3 debitage assemblage was sampled and consisted of 2,080 flakes, sampled from the middle of the courtyard (n=459; 22%), the store rooms of the north structure (n=648; 32%), the store bins of the south structure (n=426; 20%), and south of

Room A of Structure 1 (n=547; 26%). Raw material noted in the debitage includes chert and chalcedony (n=1,729; 83%), followed by quartzite (n=234; 11%), obsidian (n=62; 3%), limestone (n=32; 2%), rhyolite (n=17; 1%), and sandstone (n=6; less than 1%). Microflakes have the greatest proportion of the assemblage (n=843; 41%), while complete and proximal flakes account for 38.6% (n=676) of the assemblage. Debris accounts for a very small portion of the debitage sample (n=46; 2%) (Table 4.8).

Table 4.8 Yamashita-3 debitage dataclass.

Flake Type	Count	Percent
Complete	285	14
Flake Fragment	515	25
Proximal	391	19
Debris	46	2
Microflake	843	41
TOTAL	**2,080**	**100**

Crushed/absent platforms were the most common at 41% (n=277), followed by unmodified plain platforms at 40% (n=269), varying slightly from the platform data from Yamashita-2. The least common platform type was cortical (n=41; 6%). Lipping was seen on 22% (n=150) of the complete and proximal flakes. Splitting was only noted on 49 flakes (7%) from the assemblage (Table 4.9).

Table 4.9 Yamashita-3 platform type (of complete and proximal flakes).

Platform Type	Count	Percent
Plain	269	40
Cortical	41	6
Crushed/Absent	277	41
Faceted	89	13
TOTAL	**676**	**100**

Of the 285 complete flakes, 82% (n=243) have no cortex on their dorsal side. Only 25 flakes (9%) had greater than half their cortex intact. In addition, 88% (n=1,534) of the flake fragments had no cortex on their dorsal side. This supported the idea that early-stage reduction was not a focus of chipped stone production at the site. The high percentage of microflakes (n=843; 41%) suggests that retouching was a regular activity at the site.

Debitage size also was an indication of reduction strategies (Table 4.10). Grouping the flakes into size classes showed that the majority of complete flakes fell below two cm in length, accounting for 65% of these flakes (n=185). This figure did not include the number of microflakes (n=156), which were an overwhelming 40% of the whole debitage assemblage. All the microflakes were less than 0.5 mm in size and were the result of retouching and pressure flaking. These figures suggested that late-stage reduction strategies were occurring at the site and that retouching, likely from tool maintenance and repair, was a routine flintknapping practice at the site.

Table 4.10 Yamashita-3 size class of complete flakes.

Size Class (in mm)	Count	Percent
Under 10	185	65
10 to 20	54	19
20 to 40	38	13
Over 40	8	3
TOTAL	**285**	**100**

Debitage size also helped infer how raw material was reduced. The size class of less than 10 mm had the greatest amount of chert flakes with 68% (n=154). In contrast, 30 chert flakes measured between 20 mm to 40 mm and only 4 chert flakes are over 40 mm in length. Only 1 of the 20 obsidian flakes measured over 10 mm. None of the rhyolite flakes and only one quartzite flake measured under 10 mm. In contrast, 20 of the 35 quartzite flakes (57%) measured over 20 mm. This suggests that the size of the raw material and subsequent use of the raw material was differed between the coarser-grained materials and chert and obsidian, and may have been a result of the original size of the parent material.

Summary

The chipped stone assemblage of Yamashita-3 was comparable in size and tool type amount to Yamashita-2. Yamashita-3 produced similar results to Yamashita-2 with a focus on formal biface technology and a low rate of raw material conservation. A high percentage of unhafted bifaces (n=117; 49%) and projectile points (n=76; 32%) dominated the chipped stone assemblage. As Yamashita-3 was also a sedentary PII habitation site, a high percentage of biface technology and a limited amount of expedient technology was unusual. This high percentage of biface technology at the sites could also reflect some later Paiute occupation.

The heavy emphasis on bifaces reflected that biface production, maintenance, and repair were the most common activities at the site. Hunting technology continued to be produced and cutting and scraping activities routinely occurred at the site. The large number of bifaces in comparison to other tools at the site reflected that the site function was similar to Yamashita-2 and that the biface tool may have served as a general purpose cutting tool for plant processing of cultigens and various weedy plants. The other tool types at the site, such as drills, unifaces, and core tools, showed that other tool activities also occurred at the site but that these activities occurred at similarly low rates as at Yamashita-2.

Raw material use at the site also demonstrated that the local abundant raw material was still readily available to site inhabitants and no change occurred in access. A large proportion (n=219; 90%) of the chipped stone tools was made of CCS. The core and debitage data also suggested a focus on cryptocrystalline silicates with CCS accounting for 14 (74%) cores and 83% (n=1,729) of the debitage sample. Core reduction strategies remained similar to the other site. Initial core reduction mostly occurred off-site, but core data showed that some core reduction occurred on-site.

Both the chipped stone tool analysis and the core and debitage analysis suggested very little technological strategy contrast between it and the Yamashita-2 assemblage, although a slightly greater percentage of microflakes was noted in this assemblage, which may represent a greater emphasis on tool maintenance and repair than Yamashita-2. Thus, the data indicated that chipped stone technological strategies did not change between the time Yamashita-2 and Yamashita-3 were occupied and that raw material access and availability remained the same.

Yamashita-5N (26CK2041)

The Yamashita-5N tool and debitage assemblage was smaller than that of the previous occupations and consists of 17 stone tools (Table 4.11), 2 cores, and 250 pieces of debitage. Yamashita-5N was sampled and determined to be a PII habitation room. All artifacts were recovered from fill. No artifacts were found on the floor of the habitation room.

Table 4.11 Chipped stone tool assemblage from Yamashita-5N.

Tool Type	**Sub-Type**	**Number**	**Percent of Tool Type**
Projectile Point	Desert Side-Notched	4	57
	Cottonwood Triangular	1	14
	Rosegate	1	14
	Parowan Basal-Notched	1	14
SUBTOTAL		**7**	**100**
Other Biface	Unhafted Biface	6	100
SUBTOTAL		**6**	**100**
Uniface	Scraper	2	50
	Retouched Flake	1	50
SUBTOTAL		**3**	**100**
Core Tool	Generalized	1	100
SUBTOTAL		**1**	**100**
GRAND TOTAL		**17**	**--**

Projectile Points

Seven projectile points (4% of the chipped stone assemblage) were identified and typed: 4 Desert Side-Notched points; 1 Cottonwood point; 1 Rosegate point; and 1 Parowan Basal-Notched. All of the DSN points were made of chert, except one made of obsidian. Only the obsidian projectile point was complete and measured 19.2 mm in length. The one Cottonwood Triangular projectile point was complete and made of white chert and measured 17.2 mm in length. The one Rosegate point in the assemblage was complete and made of a mottled brown chert and measured 34.2 mm in length. The tip had been blunted and resharpened. The one Parowan Basal-Notched point was a midsection made of chert. All of these points were found in the sand fill of the habitation room.

Unhafted Bifaces

Six unhafted bifaces were analyzed, accounting for 3% of the chipped stone. Except for one medial fragment, all (n=5) were distal ends. The distal ends were Stage 5 finished bifaces. The medial fragment was a Stage 4 preform. The five distal ends were triangular in shape, with finely-retouched tips, likely representing arrow points. All the distal ends demonstrated either snap or oblique snap fractures, suggesting use-impacts. All of them were made of chert. One of these distal ends was found within the adobe rubble of the test unit in the center of the habitation room. The remaining unhafted bifaces were found in adobe rubble or loose sand of other test units dug to further uncover the habitation room.

Unifaces

Unifaces included one retouched flake and two scrapers, accounting for 2% of the chipped stone. The only retouched flake was complete and made of chert. It had unimarginal retouch. Two unifaces were thumbnail scrapers. Both were complete and were made of chert. One had a convex edge shape and the other one had a straight edge shape. All were recovered from sand fill of the habitation room.

Core Tool

One complete limestone scraper was recovered from Yamashita-5N accounting for less than 1% of the chipped stone. It was bimarginally flaked and had a convex edge shape. It was recovered from sand fill on the southwest end of the habitation room.

Cores

Two chert cores were recovered from Yamashita-5N. Both were found in loose sand fill on the west end of the habitation room. Both were exhausted and exhibited multidirectional flake removal patterns with little to no platform preparation. Both cores had less than half of their cortex intact and the number of flake removals ranged from 10 to 15. These data suggested expedient core reduction strategies not focused on conservation of raw material.

Debitage

The Yamashita-5N debitage assemblage was sampled and consisted of 250 pieces of debitage drawn from two units overlaying the habitation room. Raw material noted in the debitage assemblage included chert (n=227; 91%) and quartzite (n=23; 9%). Microflakes accounted for the majority of the assemblage (n=102; 41%), while complete and proximal fragments (n=89) were 35% of the assemblage (Table 4.12). No debris was recorded.

Table 4.12 Yamashita-5N debitage dataclass.

Flake Type	Count	Percent
Complete	30	12
Flake Fragment	59	24
Proximal	59	24
Debris	0	--
Microflake	102	40
TOTAL	**250**	**100**

Platforms recorded on complete and proximal flakes were dominated by unmodified plain platforms (n=51; 57%), followed by crushed platforms (n=17; 19%) and were similar to the previous sites (Table 4.13). Faceted platforms (n=10; 11%) were the least recorded of platform types. Little platform preparation in the form of trimming and grinding was also noted in the assemblage (less than 10%). This suggested that platform preparation was not important to the reduction strategies implemented at the site, which was odd given that the data indicated later stage reduction strategies. Additionally, a low percentage of lipping on complete and proximal flakes was observed (n=19; 21%). This was also unexpected.

Table 4.13 Yamashita-5N platform type (of complete and proximal flakes).

Platform Type	Count	Percent
Plain	51	57
Cortical	11	12
Crushed/Absent	17	19
Faceted	10	11
TOTAL	**89**	**100.0**

Of the 30 complete flakes, 73% (n=22) have no cortex. Of the 118 flake fragments, a majority 76% (n=90) have no cortex. These data suggest that late-stage reduction was occurring at the site. Dorsal flake scar count also suggests that late-stage reduction was on-going at the site. The majority of the complete flakes (n=25; 67%) had between 2 to 4 flake scars each. Only 4 complete flakes (13%) had no dorsal flake scars.

A majority of the complete flakes, 63% (n=19), fell under 20 mm, with the greatest proportion measuring under 10 mm (n=13; 43%) (Table 4.14). Only 3 flakes measured over 40 mm. Grouping these size classes by raw material, none of the coarser-grained materials fell below 20 mm. Raw material use as seen through the debitage sample was organized similarly to Yamashita-2 and Yamashita-3, with a difference between the use of the coarser-grained toolstone and CCS.

Table 4.14 Yamashita-5N size class of complete flakes.

Size Class (in mm)	Count	Percent
Under 10	13	43
10 to 20	6	20
20 to 40	8	27
Over 40	3	10
TOTAL	**30**	**100**

Summary

Few stone tools were recovered from Yamashita-5N. Yet, this smaller chipped stone assemblage demonstrated that technological strategies between Yamashita-5N and the earlier occupations remained consistent. The site activity emphasized at this site, like the earlier occupied sites, was a focus on hunting technology and cutting activities, also likely related to plant processing. The assemblage indicated that unhafted bifaces (n=7; 41%) and projectile points (n=6; 35%) accounted for the greatest proportions. Few other artifact classes were identified, but occurred at similar rates to the previous Yamashita sites.

CCS use continued to occur at high rates. A large proportion (n=15; 88%) of the chipped stone tools was made of CCS. The core and debitage data also suggested a focus on cryptocrystalline silicates with CCS accounting for 2 (100%) cores and 91% (n=227) of the debitage sample. Like the previous sites, core reduction strategies remained similar and focused on later stage reduction strategies. Initial core reduction mostly occurred off-site, possibly at quarry sites. The presence of the exhausted cores showed that any cores brought to the site were heavily used during late stages of core reduction.

Both the chipped stone tool and the core and debitage analysis suggested very little technological strategy contrast between Yamashita-5N, a late PII habitation room, and the early PII Yamashita-2 and middle PII Yamashita-3 chipped stone assemblages. Site activities were similarly focused, and raw material remained accessible and available throughout the period.

Yamashita-5S (26CK2042)

This section presents the results of the analysis of chipped stone recovered during excavations at Yamashita-5S (Table 4.15). The Yamashita-5S tool and debitage assemblage consisted of 32 stone tools, 4 cores, and 494 pieces of debitage. Yamashita-5S was sampled and surface collected. A trash deposit suggested a structure to the east, but limitations of time did not allow for excavation. Yamashita-5S (26CK2042) is a later occupation dating to AD 1290 to 1420 and placing it in the late PII/early PIII periods. All artifacts recovered were from trash contexts.

Table 4.15 Chipped stone tool assemblage from Yamashita-5S.

Tool Type	Sub-Type	Number	Percent of Tool Type
Projectile Point	Desert Side-Notched	2	16
	Cottonwood Triangular	5	38
	Rosegate	5	38
	Parowan Basal-Notched	1	8
SUBTOTAL		13	100
Other Biface	Unhafted Biface	10	91
	Drill	1	9
SUBTOTAL		11	100
Core Tools	Generalized Core Tool	5	63
	Chopper	1	12
	Scraper	2	25
SUBTOTAL		8	100
GRAND TOTAL		32	--

Projectile Points

Thirteen projectile points were recovered from Yamashita-5S (40% of the chipped stone). The projectile point assemblage included 2 Desert Side-Notched points (15%), 5 Cottonwood Triangular points (38.5%), 5 Rosegate points (38.5%), and 1 Parowan Basal-Notched (8%). All points from the site were identified to type. Two DSN points were recovered: one complete and one base. The complete point had a maximum length of 19.9 mm. Basal width of these points ranged from 6.1 to 9.8 mm. Five Cottonwood Triangular points were recovered. Only one was complete and had a maximum length of

24.7 mm. This complete point had a concave base. The other Cottonwood Triangular bases had straight basal edges (n=3) and a concave basal edge (n=1). All these points were made of chert.

Five Rosegate points were recovered. The average length of these points was 28.5 mm with a range of 19.8 to 34.2 mm. The average width of these points was 16.9 mm; the average thickness 4.0 mm; and the average weight 1.5 grams. All were complete or in nearly complete condition except for one base. The five Rosegate arrow points represented the point type at the site that featured the greatest evidence of reworking. Reworking was noted to have occurred most extensively near the stem and barbs of these projectile points, likely the result of damage near the corner notches of these points. All were made of chert. One Parowan Basal-Notched point was also identified. It was nearly complete with a length of 31.2 mm and was made of chert.

Unhafted Bifaces

Ten unhafted bifaces were analyzed (31% of the chipped stone). One was a base, one was a fragmentary biface, and the other eight were distal ends. Only one distal end was made of obsidian; the rest (n=9) were chert. All of the distal tips appear to represent finished projectile point tips.

Drill

One complete drill with a diamond-shaped bit made of chalcedony was recovered (3% of the chipped stone). One lateral edge was straight-shaped. The other edge had a small concavity near its base. It was found on the surface.

Core Tools

A total of eight core tools were found (25% of the chipped stone). One chopper was recovered. The one chopper made of limestone was unifacially flaked and there was no evidence of other modification but on this edge. Two core tool scrapers were recovered. One was a limestone scraper and the other was made of quartzite. Both were unifacially flaked. The limestone scraper had evidence of battering on the opposite corner of the flaked edge. Both had convex edge shapes. Five additional core tools were recovered. One was made of diorite and the others (n=4) were made of chert. The diorite core tool showed evidence of very light battering on one of its corners and had a straight edge. All the chert core tools had been bimarginally flaked with steep edge angles. Core tools accounted for a greater proportion of the assemblage than the previous sites. It was unclear whether this was a result of recovery bias during the collection of this sample or a true representation of proportional differences and an increase in site activities conducted with heavy core tools.

Cores

Four complete cores were recovered: three made from quartzite and one from chert. Two of these cores were lightly used with between 2 to 4 flakes removed from each core. They were comparable in size and both have approximately 50% of their cortex intact. The other quartzite core had a large proportion of cortex remaining (approximately 80%) with approximately seven flake removals. The one chert core had been moderately used with eight flake removals. All exhibited a multidirectional pattern of flake removal and no platform preparation. These data suggested a lack of raw material conservation.

Debitage

The debitage assemblage was sampled from trash contexts at the site and consisted of 494 pieces of debitage drawn from five units (Table 4.16). Raw material in the debitage included chert (n=415; 84%); quartzite (n=56; 11%); obsidian (n=11; 2%); rhyolite (n=9; 1%); basalt (n=2; 1%); and, limestone (n=1; 1%). Microflakes accounted for the greatest proportion of the assemblage (n=151; 31%), while complete and proximal flakes (n=151) accounted for 30%.

Table 4.16 Yamashita-5S debitage dataclass.

Flake Type	Count	Percent
Complete	61	12
Flake Fragment	127	26
Proximal	90	18
Debris	65	13
Microflake	151	31
TOTAL	**494**	**100**

Complete and proximal flakes were dominated by plain platforms (n=90; 60%), followed by crushed platforms and absent platforms (n=34; 23%), which were found in comparable rates to the other sites. Cortical platforms were the least recorded platform type (7%) (Table 4.17). Platform preparation was noted in the form of trimming and grinding in less than 15% of the assemblage. Lipping was noted 41% (n=62) of all the complete and proximal flakes, while very little splitting was recorded (n=25). Debris (or shatter) did not account for a large percentage of the assemblage. The debitage data thus suggested a preference for soft-hammer percussion at the site.

Of the 61 complete flakes, 48% (n=29) had no cortex. All of these flakes were made of chert. Of the 217 flake fragments, 43% (n=93) had no cortex. These data suggested that primary flake reduction was not occurring at the site and that the debitage from the site primarily consists of secondary and tertiary flakes, supporting the use of soft hammer percussion techniques.

Table 4.17 Yamashita-5S platform type (of complete and proximal flakes).

Platform Type	Count	Percent
Plain	90	60
Cortical	11	7
Crushed/ Absent	34	23
Faceted	16	20
TOTAL	**151**	**100**

Dorsal flake scar count and size class also suggested that late-stage reduction was on-going at the site (Table 4.18). The complete flakes from Yamashita-5S (n=25; 41%) had between 2 to 4 flake scars each. Only 61 complete flakes 6 (10%) had no dorsal flake scars. A majority of the complete flakes, 74% (n=45), fell under 20 mm, with the greatest proportion of complete flakes measuring under 10 mm (n=26; 43%). Only 2 flakes measured over 40 mm. Grouping the flakes into size classes showed that the majority (n=45; 71%) of complete flakes were less than 20 mm in length. Collectively, this debitage data indicated that the initial reduction of cores did not occur at the site as frequently as later core reduction strategies did.

Table 4.18 Yamashita-5S size class of complete flakes.

Size Class (in mm)	Count	Percent
Under 10	26	43
10 to 20	19	31
20 to 40	14	23
Over 40	2	3
TOTAL	**61**	**100**

Debitage size indicated that raw materials were reduced in different ways. Of the 25 complete chert flakes, 63% were less than 10 mm, followed by 38% (n=15) that measure between 10 mm and 20 mm. The coarser-grained materials, i.e. rhyolite and quartzite occurred in greater quantities (62%; n=8) in size classes between 20 and 40 millimeters. Later stage reduction strategies were focused on the finer-grained toolstone.

Summary

Yamashita-5S dated later than the other Yamashita sites and was occupied during the early PIII period, yet the assemblage was similar to the PII Yamashita sites. Formal biface technology was the most common technology found at the site. Like the other sites, a high percentage of unhafted bifaces (n=10; 31%) and projectile points (n=13; 40%) dominated the chipped stone assemblage. Site function focused on the production and maintenance of hunting technology and cutting activities, done with multi-purpose bifaces, also probably related to plant processing. Few other artifact classes were identified, but occurred at similar rates to the previous Yamashita sites indicating that chopping activities occurred at some capacity at the site.

Raw material at the site also demonstrated that its accessibility and availability was not restricted. A large proportion (n=29; 85%) of the chipped stone tools was made of CCS. The core and debitage data also suggested a focus on cryptocrystalline silicates with CCS accounting for 14 (74%) cores and 83% (n=1,729) of the debitage sample. Like the previous occupations, core reduction strategies remained similar. Initial core reduction probably occurred off site, but at least some later core reduction occurred on-site.

Few cores were found and the sample size of the debitage assemblage was much smaller than at the other sites. The analysis of cores and debitage, however, showed a heavy preference toward quartzite and secondarily toward chert. This was different from the other Yamashita sites, which exhibited predominant use of local CCS toolstone for core reduction and tool production.

No significant change in tool assemblages with regard to tool type diversity was noted at Yamashita-5S compared to the other earlier occupations but core data, though limited, may represent a change in raw material availability.

CHAPTER 5

YAMASHITA SITES: COMPARISON AND DISCUSSION

This chapter compares the results of the analysis of the Yamashita sites' chipped stone assemblages and includes discussion of bifaces, unifaces, core tools, cores, and debitage. These results are organized into sections that correspond to the research questions. so as to explicitly address the research domains of tool design, tool use as it corresponds specifically to occupation duration, and raw material use. Tool design results pertain to the first and third research questions. The first section of tool design is organized by tool type and addresses their patterns of manufacture, standardization of tool form, re-use, and tool function. The second section of tool design provides discussion of the expedient use of technology, the reduction strategies at the sites as inferred via core and debitage data, and the implications of these results. The raw material use section provides discussion of toolstone use in the various tool type classes at and between the sites, as well as a discussion of the sourcing results of a selected obsidian sample.

Tool Design

The overall counts for each tool type category are displayed in Table 5.1. The assemblage sizes were not proportionate across all of the Yamashita sites. Yamashita-2 had the largest assemblage and contained more than ten times the total number of tools than that of the smallest assemblage, Yamashita-5S. This was a result of the excavation strategies conducted at Yamashita-2 and Yamashita-3 versus the sampling strategies and time constraints at Yamashita-5N and Yamashita-5S. Statistics were not run on these data due to small sample sizes and the disparities in assemblage sizes. Instead results and interpretations were focused on proportions in and across the Yamashita sites.

Table 3.1 in a previous chapter provided the tool attributes identified during chipped stone analysis. Tool attributes specifically pertaining to tool design focused on tool type; metric dimensions, edge angle, and edge shape as applicable.

Table 5.1 Total tool counts from each site.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Projectile Point	88	26	76	31	7	41	13	41	**184**
Unhafted Biface	175	51	117	48	6	35	10	32	**308**
Knife	2	1	7	3	0	0	0	0	**9**
Drill	16	5	3	1	0	0	1	3	**20**
Scraper, Unifacial	6	2	1	1	2	12	0	0	**9**
Denticulate	2	1	0	0	0	0	0	0	**2**
Retouched Flake	36	10	28	11	1	6	0	0	**65**
Composite Tool	1	< 1	0	0	0	0	0	0	**1**
Chopper	1	< 1	3	1	0	0	1	3	**5**
Core Tool	13	4	5	2	1	6	5	15	**24**
Scraper, Core Tool	0	0	4	2	0	0	2	6	**6**
TOTAL	**340**	**100**	**244**	**100**	**17**	**100**	**32**	**100**	**633**

Tool types at the Yamashita sites included bifaces, unifaces, and core tools. The tool type that accounted for the largest proportion of chipped stone tools was bifaces at all of the sites. Unhafted bifaces represent the largest number from Yamashita-2 and Yamashita-3 and was followed by another biface category, projectile points. At the two later-dated sites, Yamashita-5N and Yamashita-5S, projectile points were the most common and unhafted bifaces were the second most common. Overall, all of the site assemblages were dominated by bifacially flaked tool types (Figure 5.1).

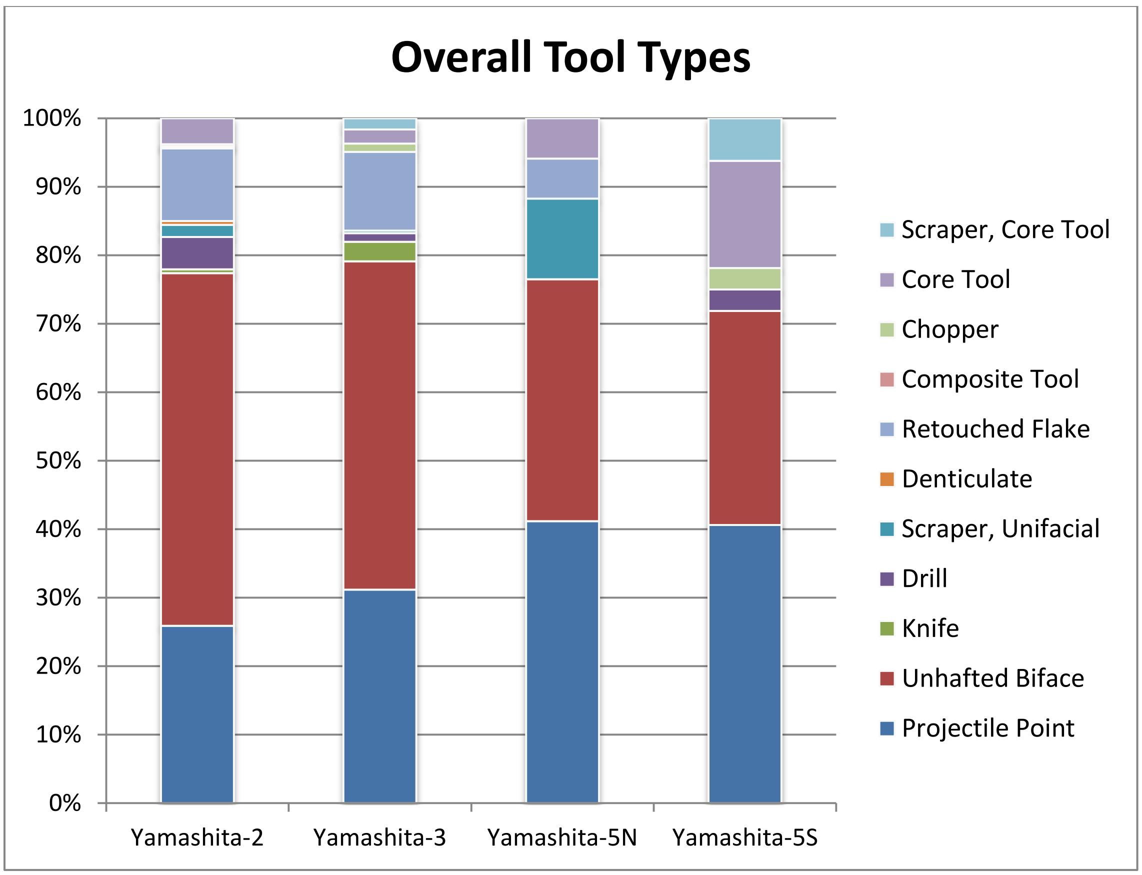

Figure 5.1 Percentages of overall tool types across the sites

Projectile Points

Alongside unhafted bifaces, projectile points were the most common tool type at the Yamashita sites. Projectile point typological series identified included Rosegate, Parowan Basal-Notched, Desert Side-Notched, and Cottonwood projectile points (Table

5.2). These series entered the region at different times. The proportions of point types across the sites remained similarly high, accounting for the following proportions of overall tool counts: 21% (n=88) of Yamashita-2, 31% (n=76) of Yamashita-3, and 41% at both Yamashita-5N (n=7) and Yamashita-5S (n=13) (Figure 5.2).

Dart points were also identified, but were not numerous and accounted for 4% (n=3) of Yamashita-2, 3% (n=2) of Yamashita-3's projectile point counts, and were absent at Yamashita-5N and Yamashita-5S. Most of these points were side-notched: 75% (n=3) at Yamashita-2 and 50% (n=1) at Yamashita-3. The dart points from Yamashita-2 were basal portions and those from Yamashita-3 were complete. The second point from Yamashita-3 did not resemble the other points and shared a similar morphology and cross-section to a Lake Mohave point as illustrated in Warren and Crabtree (1986: 185). This point was probably collected prehistorically. Given its intact condition, it may represent use as a fetish. The other dart points were also possibly collected as fetishes or for the purposes of retooling.

Table 5.2 Projectile point counts across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
DSN	21	24	19	25	4	58	2	16	**46**
Cottonwood	14	16	18	24	1	14	5	39	**38**
Rosegate	11	12	18	24	1	14	5	39	**35**
Parowan	5	6	3	4	1	14	1	6	**10**
Dart points	2	2	2	3	0	0	0	0	**4**
Not Assigned	35	40	16	20	0	0	0	0	**51**
TOTAL	**88**	**100**	**76**	**100**	**7**	**100**	**13**	**100**	**184**

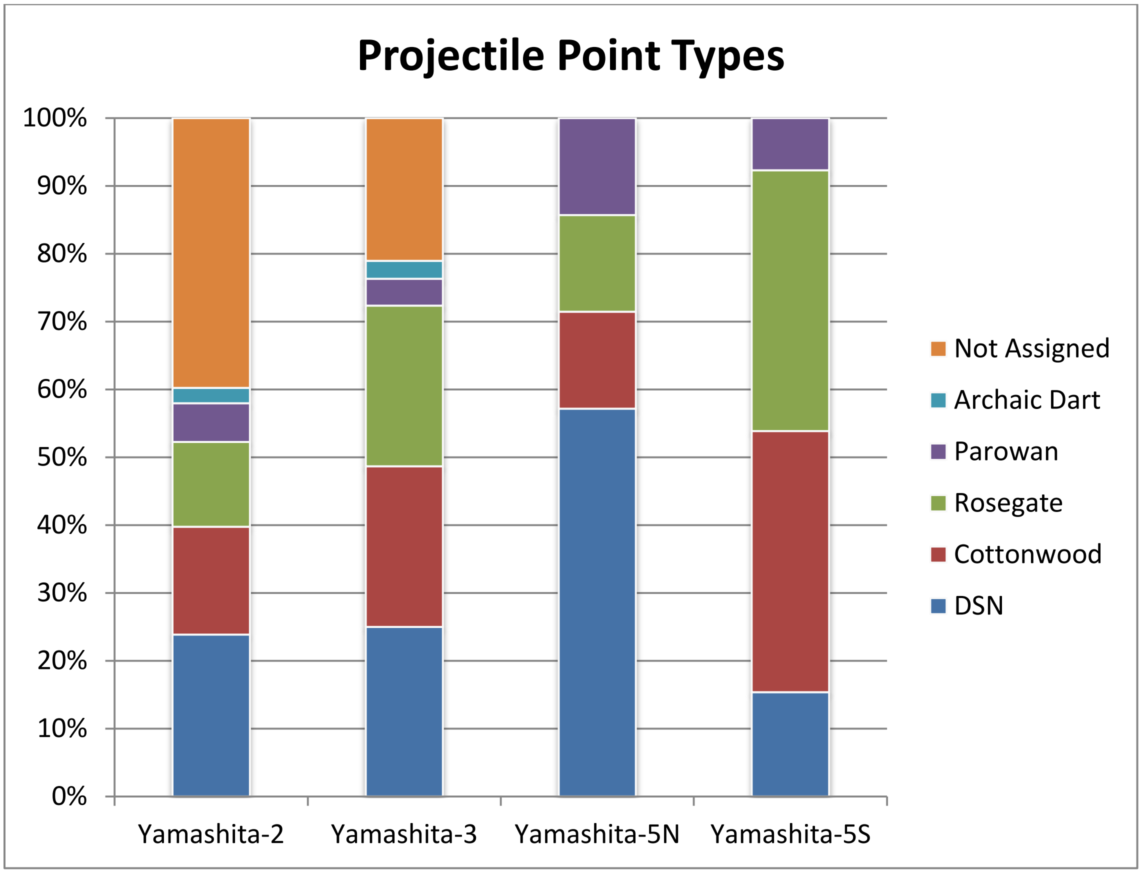

Figure 5.2 Percentages of projectile point types across the sites.

Rosegate series is a composite cluster consisting of Eastgate Expanding Stem and Rose Springs Corner-Notched projectile points. This point series marked the earliest development of bow and arrow technology in the Great Basin with the series appearing roughly AD 750 (Justice 2002). The points were present in various projectile points assemblages recovered across VBP sites in the area such as PII period Bovine Bluff (Myhrer 1985:46) and various Lost City sites (Shutler 1961) as well as early PIII sites such as Mesa House (Hayden 1930: 62). Their morphological variability was also seen in points recovered from the Yamashita sites.

This point cluster was not distinguished as separate Rose Springs and Eastgate point types during this analysis due to their morphological similarity and temporal overlap (see Thomas 1983). Variability, primarily found along the stem, was noted in their morphology due to the composite nature of the point series. The majority of the points recovered from Yamashita-2 morphologically resembled Rose Springs Corner-Notched (n=10). Only one point had an expanding stem. Expanding stems within this series was noted more frequently (n=6) in the Rosegate points of Yamashita-3.

Of the Yamashita sites' projectile point counts, Rosegate points accounted for 12% (n=11) of Yamashita-2; 24% (n=18) of Yamashita-3; 14% (n=1) of Yamashita-5N, and 39% (n=5) of Yamashita-5S. The type accounted for a slightly larger proportion of the tool class in Yamashita-3 than at Yamashita 2, but this may have been due to the larger number of fragmentary projectile points at Yamashita-2. Rosegate series points did not dominate any of the site's projectile point counts, except for Yamashita-5S. The increase in Rosegate points at Yamashita-5S was likely a sample size issue. With the exception of a larger number of expanding stems in Yamashita-3, no clear chronological division of the point type across the sites was noted and the continued use of the point type occurred throughout the PII and early PIII contexts at the Yamashita sites.

Parowan Basal-Notched points have often been clustered under the Rosegate series due to their technological and morphological similarities (Justice 2002). Parowan Basal-Notched as a point type differs from Rosegate in its form and notching design. Parowan points can vary in blade length, but generally exhibit an elongated isosceles triangular blade with shallow basal notching, forming a base with a proximal straight edge. The points are generally manufactured using pressure flaking in a random pattern and serration is common along blade edges. The Parowan series is more commonly noted at Fremont sites dated to AD 950 – 1200 (Holmer and Weder 1980: 64) and after occurs in large numbers. They have also been documented in the upland VBP area throughout the PII and PIII periods at sites such as Granary House, Peter's Pocket, Coyote Site and Corn Cob Site (Wambach 2014). Little Fremont material culture has been noted at VBP sites in the Moapa Valley, yet the presence of Parowan points alongside Rosegate points has been documented in the region (Justice 2002). In the Moapa Valley, VBP sites, including various Lost City sites and the PIII period Mesa House have points that morphologically resemble Parowan Basal-Notched points in their assemblages. However in the reports points were morphologically described rather than typologically classified (Shutler 1961: Plates 64-66) (Hayden 1930: Figure 11). Though Fremont material culture is limited in the area, the presence of Parowan Basal-Notched points at lowland VBP sites likely suggests that the production of this point type was not restricted only to the Fremont area and was produced by VBP populations in the uplands as well as possibly in the valley.

At the Yamashita sites, all of the Parowan points shared similar manufacturing methods with a random pressure-flaking pattern used. The Parowan points from across the occupations were similar in dimensions, except for two Parowan points from Yamashita-3, exceeding 50 mm in length. These two points shared similar metric dimensions and design choices including serration and similarly reworked stems. Given their similarity, these two points were most likely the result of their production by one individual.

Across the sites, Parowan points were seen in small numbers. Of the Yamashita sites' projectile point counts, Parowan Basal-Notched points accounted for 6% (n=5) of Yamashita-2, 4% (n=3) of Yamashita-3, 14% (n=1) of Yamashita-5N, and 6% (n=1) of Yamashita-5S. With the exception of dart points, Parowan type points accounted for the smallest proportion of typed points at the sites, suggesting that while finished Parowan points were probably traded into the area, it was not common.

Cottonwood projectile points are a type that enters the archaeological record in the area at approximately AD 900 and its use persists until the historic period (Justice 2002). They are small un-notched triangular arrow points and are ubiquitous across prehistoric sites in the west. Because of their generic form, the Cottonwood Triangular point type incorporates a high degree of variability in form and size. In the Moapa Valley, VBP sites, including various Lost City sites and Mesa House have substantial numbers of this point type (Shutler 1961; Hayden 1930).

Of the Yamashita sites projectile point counts, Cottonwood Triangular points accounted for 16% (n=14) of Yamashita-2, 24% (n=18) of Yamashita-3, 14% (n=1) of Yamashita-5N, and 39% (n=5) of Yamashita-5S. The Cottonwood Triangular points ranged in dimensions from 10 mm to 26 mm and straight bases (n=24) dominated this point type, accounting for 57% (n=8) at Yamashita-2, 67% (n=12) at Yamashita-3, and 100% (n=4) at Yamashita-5N. Concave bases were also present across the sites, accounting for 43% (n=6) of Yamashita-2 and 33% (n=5) of Yamashita's 3 Cottonwood points. At Yamashita-5S, 100% (n=2) of the Cottonwood points recovered from the sample units had concave bases. Only one leaf-shaped Cottonwood was recovered from Yamashita-3.

The Cottonwood Triangular points at the Yamashita sites exhibited variability in their manufacturing method. While the majority had a random flaking pattern that reached across the entire surface of both faces, four points found at Yamashita-3 and one from Yamashita-5S were produced on a curvilinear flake with one face having a flaking pattern stretching to the center of the artifact. This was done through pressure flaking while the other face was pressure flaked only along the margins and along the haft element. This may suggest two methods of manufacture for this point type and possibly represents different flintknapping learning frameworks or manufacturing locales. As Cottonwood points were in use over a large swath of time in the Southwest, their presence at the Yamashita sites was expected.

Desert Side-Notched (DSN) points do not enter the archaeological record until approximately AD 1100 to 1200 and post-date Rosegate and Parowan Basal-Notched projectile points (Justice 2002). These points are generally smaller in form than earlier points and are triangular in shape with side notches and a straight or concave base. They are found at a range of prehistoric sites in the southwest. In the Moapa Valley, VBP sites have substantial numbers of this point type, including sites in Lost City (Shutler 1961: Plate 65).

Of the Yamashita sites' projectile point counts, DSN points accounted for 24% (n=21) of Yamashita-2; 25% (n=19) of Yamashita-3; 58% (n=4) of Yamashita-5N, and 16% (n=2) of Yamashita-5S. Like Cottonwood points, DSN points demonstrated variability in dimensions and manufacturing method. At the Yamashita sites, the DSN points ranged in dimensions from 15 mm to 30 mm and the Sierra subtype, noted through a deep central notch, (n=37) dominated this point type, accounting for 95% (n=20) of Yamashita-2, 74% (n=14) at Yamashita-3, 75% (n=3) at Yamashita-5N, and 50% (n=1) at Yamashita-5S. The DSN points at the Yamashita sites also exhibited variability in their manufacturing method. Like Cottonwood points, the majority had undergone a random flaking pattern that reached across the entire surface of both faces. One obsidian point from Yamashita-3 was manufactured on a curvilinear flake with only one face having a flaking pattern stretching to the center of the artifact. This was done through pressure flaking while the other face was pressure flaked only along the margins and along the haft element. Like Cottonwood points, this may also suggest two methods of manufacture for this point type and possibly reflects different flintknapping learning frameworks, manufacturing locales, or some later Paiute occupation at the sites.

Hafted Retouch Index (HRI)

Projectile points were also examined to understand the type of retouch patterns they exhibited and if toolstone was being used in different ways in this tool class. Rosegate series (n=19), Parowan Basal-Notched (n=8), and DSN series (n=36) were the only types the HRI was collected, due to artifact counts, artifact morphology, and the number of complete points that could be measured. Given the small sample sizes, projectile points that were used were not separated by site and HRI was simply calculated to determine if any of the points were more extensively retouched than another series across all the sites and not at specific sites.

If toolstone was preferentially treated, then the HRI values of the projectile points should have been high. Andrefsky (2006) measured experimentally produced projectile points with mean HRI values that showed values specific to resharpening practices. Unsharpened projectile points produced a mean HRI value of 0.246; while five-time resharpened projectile points produced a mean HRI value of 0.822. Twice or thrice resharpened points had a mean HRI value in-between, of 0.603 and 0.674 (Andrefsky 2006, 755).

Results from the Yamashita sites (Table 5.3; Figure 5.3) suggested that the majority of the projectile points underwent similar rates of moderate retouch, but did not have high rates of resharpening, which was surprising as biface technology was so common. Retouch of the local CCS material, on which most of the points were made, did not substantially increase on any of the diagnostic types. Given obsidian's rarity in the assemblages, it was also expected that obsidian may have experienced higher rates of resharpening than the local CCS. Yet only a small increase in retouch index levels occurred. The six obsidian points, five of which were DSN had an HRI of 0.391 compared to overall chert levels of 0.363. HRI values were also collected for the diagnostic point types. HRI values overall suggested that Rosegate points were possibly resharpened at a slightly higher rate than DSN points, yet it did not appear that a resharpening preference was given to one series over another at a significant rate. Overall, HRI values did not show that points were resharpened at high rates, nor did it show that raw material conservation was a primary concern with regard to specific raw material or within particular diagnostic projectile point types. Given the large proportions of the chipped stone assemblages that the projectile points accounted for, higher rates of resharpening were expected to maintain the advantage of a sharp tool edge, but the results did not indicate this. The lack of raw material conservation in the tool class however was similar to other raw material conservation practices at the sites and suggested that raw material conservation was not prioritized.

Table 5.3 HRI values of projectile points.

	Min.	**Max.**	**Average HRI**
Desert Side-Notched	0.063	0.688	0.368
Rosegate	0.156	0.750	0.399
Parowan	0.063	0.688	0.313

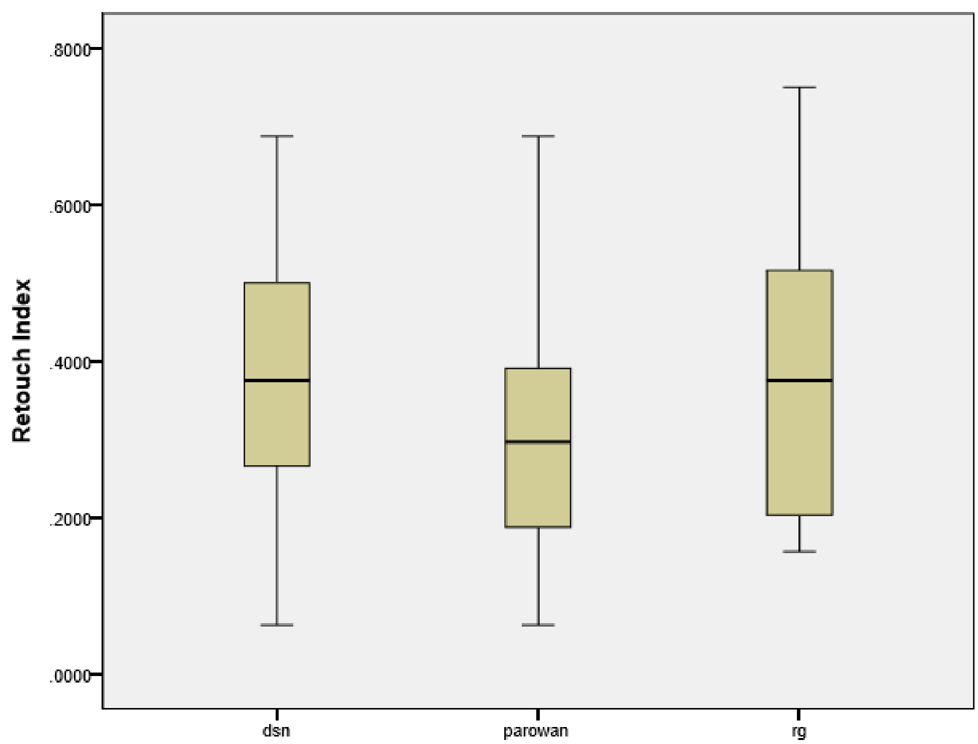

Figure 5.3 HRI on complete projectile points from the Yamashita sites.

The large proportions of projectile points at the Yamashita sites were unusual and unexpected according to theoretical expectations. However, given that all of the Yamashita sites have projectile point proportions that are similar and other tool types that are limited in number, the presence of this biface technology appears to reflect a true representation of organization of technology at the sites instead of the result of recovery biases.

The function of the production and maintenance of projectile points at the Yamashita sites is assumed to be for hunting technology. Faunal analysis at the Yamashita sites has yet to be completed, but at least one site from the lowland VBP area has shown that large mammals were perhaps being hunted regularly by the inhabitants in the valley and that low population densities in the area probably did not diminish large game numbers in the vicinity (Harry and Watson 2010).

Other interpretations such as interpersonal violence are also possible. However, the body of bioarchaeological data related to the lowland VBP, while very limited, does not suggest that interpersonal violence was common. For example, during an examination of skeletal remains from various Lost City sites, most of the trauma was attributed to accidents rather than interpersonal violence (Martin and Thompson 2008).

Unhafted Bifaces

Unhafted bifaces were found in high proportions at the Yamashita sites and accounted for 51% (n=175) of Yamashita-2, 48% (n=117) of Yamashita-3, 35% (n=6) of Yamashita-5N, 32% (n=10) of Yamashita-5S. Similar proportions of unhafted bifaces were found between Yamashita-2 and Yamashita-3, representing approximately half of their entire chipped stone assemblages. Like projectile points, the disproportionate numbers of unhafted bifaces is unusual at sedentary sites like these.

The greatest proportions of unhafted bifaces were late stage bifaces in the form of Stage 5-finished bifaces. Similar proportions of these finished bifaces (45% (n=79) at Yamashita-2, 56% (n=65) at Yamashita-3, and 90% (n=9) at Yamashita-5S) were recovered. Yamashita-5N had no Stage 5 finished bifaces, but of the few unhafted bifaces at the site, the majority recovered were late-stage preforms (80%; n=5). Yamashita-5S also had few bifaces (n=10) compared to Yamashita-2 and Yamashita-3, but unhafted bifaces were similarly clustered into the middle to late stages. Alongside the numbers of projectile points recovered, these finished bifaces suggest that hunting projectile technology dominated the all of the Yamashita sites' chipped stone assemblages (Table 5.4; Figure 5.4). Stage 5-finished bifaces at these sites represented the distal ends of finished bifaces with no evidence of hafting. These distal ends were likely the result of breakage during the use of hunting projectile point technology. This is in concurrence with the large numbers of projectile points at all of the sites and their presence may represent their removal from a kill transported on-site and suggest a more diversified diet in contrast to a dependence on agricultural crops for consumption (Keeley 1982). It is also possible that they broke during manufacture.

Not all of the unhafted bifaces were in the late-stage forms at the sites, however. Stages 1 through 3 bifaces accounted for 34% (n=59) of Yamashita-2, 33% (n=38) of Yamashita-3, 20% (n=1) of Yamashita-5N, and 10% (n=1) of Yamashita-5S. These earlier stage bifaces were also represented in quantities that were surprising for these site types. The bifaces recovered suggested that the bifaces were being manufactured and that they undergoing the full continuum of biface tool production, likely to be used for a range of activities.

Since a biface is continually transformed, as a tool it can fulfill a range of roles throughout its use-life (Andrefsky 2005). As an early stage tool, its larger angle and thicker edge can allow it to be used for activities including chopping and sawing. Once thinned to a later stage biface, an acute edge angle can provide a tool capable of finer cutting and slicing activities. Thus, these large numbers of unhafted bifaces across the Yamashita sites show a preference for multi-purpose cutting and scraping tools, probably for plant processing. The similarity in the proportions of biface stages between the sites suggests that the technological strategies of favoring such a tool type remained consistent between the occupations.

Table 5.4 Unhafted biface stages count across the sites.

	Yamashita -2		**Yamashita -3**		**Yamashita -5N**		**Yamashita -5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Stage I Blank	2	1	1	1	0	0	0	0	**3**
Stage 2 Edged	31	18	15	13	0	0	0	0	**45**
Stage 3 Thinned	26	15	22	19	1	20	1	10	**49**
Stage 4 Preform	24	13	8	7	5	80	0	0	**33**
Stage 5 Finished	79	45	65	56	0	0	9	90	**158**
Fragment	13	8	6	5	0	0	0	0	**20**
TOTAL	**175**	**100**	**117**	**100**	**6**	**100**	**10**	**100**	**308**

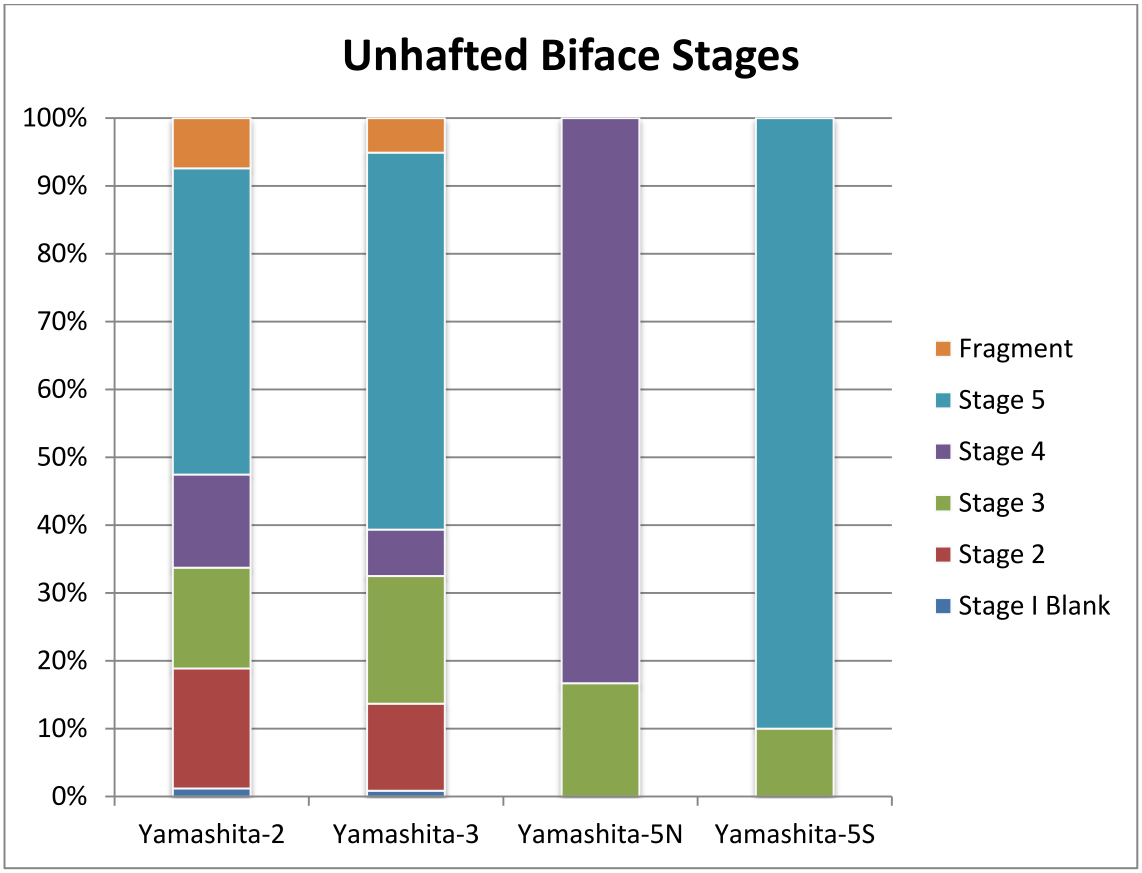

Figure 5.4 Percentages of unhafted biface stages across the sites.

Other Bifaces

Other bifacial tool types included drills and knives. Their numbers were much smaller than that of unhafted bifaces (Table 5.5; Figure 5.5). Of the overall chipped stone assemblage counts from the Yamashita sites, these bifaces accounted for 6% (n=18) of Yamashita-2, 4% (n=10) of Yamashita-3, 0% (n=0) of Yamashita-5N, and 3% (n=1) of Yamashita-5S. No drills or knives were recorded from Yamashita-5N, and Yamashita-5S had one drill bit. A difference was noted in the proportion of knives and drills between Yamashita-2 and Yamashita-3. More drills were recovered from Yamashita-2 (n=16; 5%) compared to Yamashita-3 (n=3; 1%). Different forms were also recorded including T-shaped, straight, and projectile point type bases (primarily identified as belonging to Rosegate and Parowan series). The bits of the drills also varied between blunt and diamond-shaped and sharp and triangular, presumably from varying use and initial flake morphology.

Table 5.5 Bifacial tool types across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Unhafted Bifaces	175	91	117	92	6	100	10	90	**308**
Knife	2	1	7	6	0	0	0	0	**9**
Drill	16	8	3	2	0	0	1	10	**20**
TOTAL	**193**	**100**	**127**	**100**	**6**	**100**	**11**	**100**	**337**

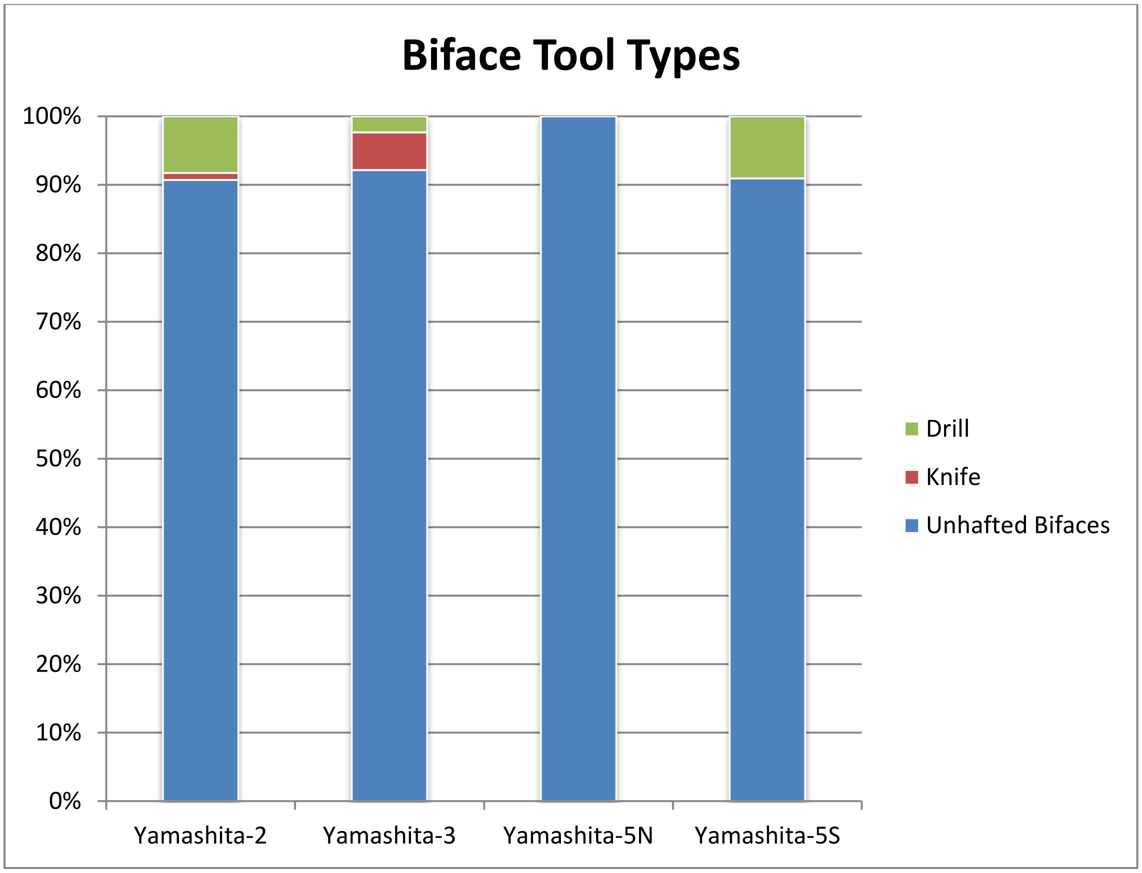

Figure 5.5 Percentages of bifacial tool types across the sites.

Two knives (1%) were recovered from Yamashita-2, while seven (3%) were recovered from Yamashita-3. Thin, fine pressure-flaked knives have been noted in the area at various other VBP sites (Hayden 1930; Myhrer 1989; Lyneis et al. 1989) and may have been hafted as shown at Mesa House (Hayden 1930: Figure 4: p. 100).

Overall, drills and knives comprised a small percentage of the various sites' chipped stone assemblages. The differences in the proportions between drills and knives may suggest a difference in favored bifacial tool design and the types of site activities occurring at the sites. While no microscopic analysis was conducted on the tools, drills and knives are generally considered to be used for different types of activities, with drills used as implements to bore various materials including wood, bone, antler, shell, and ceramics. Knives can be used on different activities focused on cutting and slicing, or as multi- purpose tools (Sliva 1997). These differences may also be representative of the different use-lives of bifaces. As bifaces generally have a long use-life, tools such as drills and knives may have been produced after particular unhafted bifaces and projectile points lost utility to the inhabitants at the sites. For example, drills have been noted to have been manufactured from projectile points after repeated resharpening has limited their utility to function as projectiles (Sliva 1997: 48). Another possibility is that the differences in the proportions of these tools simply are a result of the small sample size from the sites. Regardless, although limited in number, the recovery of drills at the sites showed that boring activities that were not focused on the processing of cultigens and wild plants were sometimes occurring on-site.

Unifaces

Unifaces included scrapers, denticulates, and retouched flakes (Table 5.6). Unifaces were not present in large quantities at the sites and accounted for 13% (n=44) of Yamashita-2, 12% (n=29) of Yamashita-3, 18% (n=3) of Yamashita-5N, and 0% of Yamashita-5S's overall chipped stone assemblage. Edge shapes of unifacial tools included a straight or convex profile along the modified edge. The most common edge shape across the sites of scrapers and denticulates were convex, accounting for 80% (n=6) at Yamashita-2, 100% (n=1) at Yamashita-3, and 50% (n=1) at Yamashita-5N of the uniface counts indicating that they were used for cutting and slicing activities (Table 5.7).

Both scrapers and denticulates have been documented to function as tools used in plant processing and fresh hide processing (Sliva 1997: 92). Additional activities associated with scrapers include wood working and dry hide curing. Functional variation may be reflected in the different types of retouch patterns between scrapers and denticulates. The different proportions of scrapers between the sites may suggest an increased processing activity, possibly hide working, in the earlier occupation of Yamashita-2. The small number of denticulates, which were only present at Yamashita-2, demonstrated little occurrence of processing activities that may have been focused on wood. The small number of these types of tools across the sites indicated that the activities that these tools functioned for were not common at the sites or were fulfilled by other tool types at the sites. The great proportion of biface technology recovered from the sites easily could have replaced the role of these uniface tools, particularly earlier-stage bifaces with durable edges and obtuse angles.

Table 5.6 Uniface count across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Scraper	6	14	1	3	2	67	0	0	**9**
Denticulate	2	6	0	0	0	0	0	0	**2**
Retouched Flake	36	82	28	97	1	33	0	0	**65**
TOTAL	**44**	**100**	**29**	**100**	**3**	**100**	**0**	**0**	**76**

Table 5.7 Edge shape of scrapers and denticulates across the sites.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Convex	6	80	1	100	1	50	0	0	**8**
Straight	2	20	0	0	1	50	0	0	**3**
TOTAL	**8**	**100**	**1**	**100**	**2**	**100**	**0**	**0**	**11**

Retouched flakes accounted for the greatest proportion of unifaces at the sites, but only represented the following overall tool percentages: 10% (n=36) of Yamashita-2, 11% (n=28) of Yamashita-3, 6% (n=1) of Yamashita-5N, and 0% (n=0) of Yamashita-5S. The limited use of retouched flakes across the sites indicated that expedient use was not common, but did occur, during some cutting or scraping activities. This ran contrary to the expectation of increased use of expedient tools at the Yamashita sites.

Retouched flakes were identified according to their type of retouch: bifacial or unifacial (Figure 5.6). From Yamashita-2, 95% (n=33) of the retouched flakes exhibited unifacial retouch. This proportion was less at Yamashita-3 (n=16; 57%). Yamashita-5N only had one unifacially retouched flake and Yamashita-5S had none. Bifacial retouch on retouched flakes in Yamashita-3 occurred on nearly half of the retouched flakes at the site. The increase of bifacial retouch at Yamashita-3 compared to Yamashita-2, however, suggested more intensive reduction of these flakes. An increased use of expedient technology perhaps occurred in this slightly later occupation.

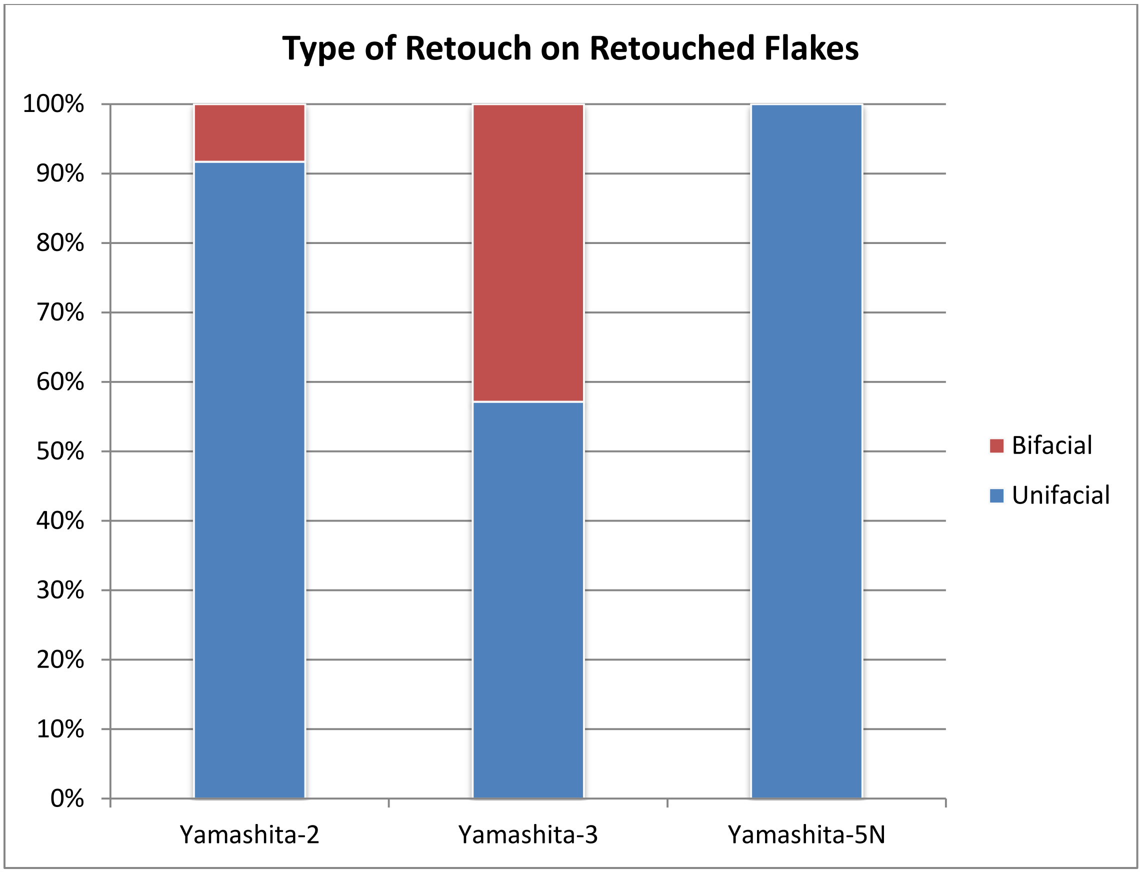

Figure 5.6 Percentages of unifacial and bifacial retouched flakes across the sites.

Core Tools

Core tools included choppers, scraper core tools, and other core tools (Table 5.8; Figure 5.7). Of the overall chipped stone tool counts of the Yamashita sites, core tools accounted for 4% (n=12) of Yamashita-2, 5% (n=14) of Yamashita-3, 6% (n=1) of Yamashita-5N, and 24% (n=8) of Yamashita-5S. The majority of the core tools (63%) at the sites fit within generalized core tool parameters. These general core tools accounted for the greatest proportion of core tools at all the sites: 90% (n=13) at Yamashita-2, 42% (n=5) at Yamashita-3, 100% (n=1) at Yamashita-5N, and 63% (n=5) at Yamashita-5S.

Table 5.8 Core tool count across the sites.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chopper	1	10	3	25	0	0	1	12	**5**
Scraper, Core Tool	0	0	4	33	0	0	2	25	**6**
Generalized Core Tool	13	90	5	42	1	100	5	63	**24**
TOTAL	**14**	**100**	**12**	**100**	**1**	**100**	**8**	**100**	**35**

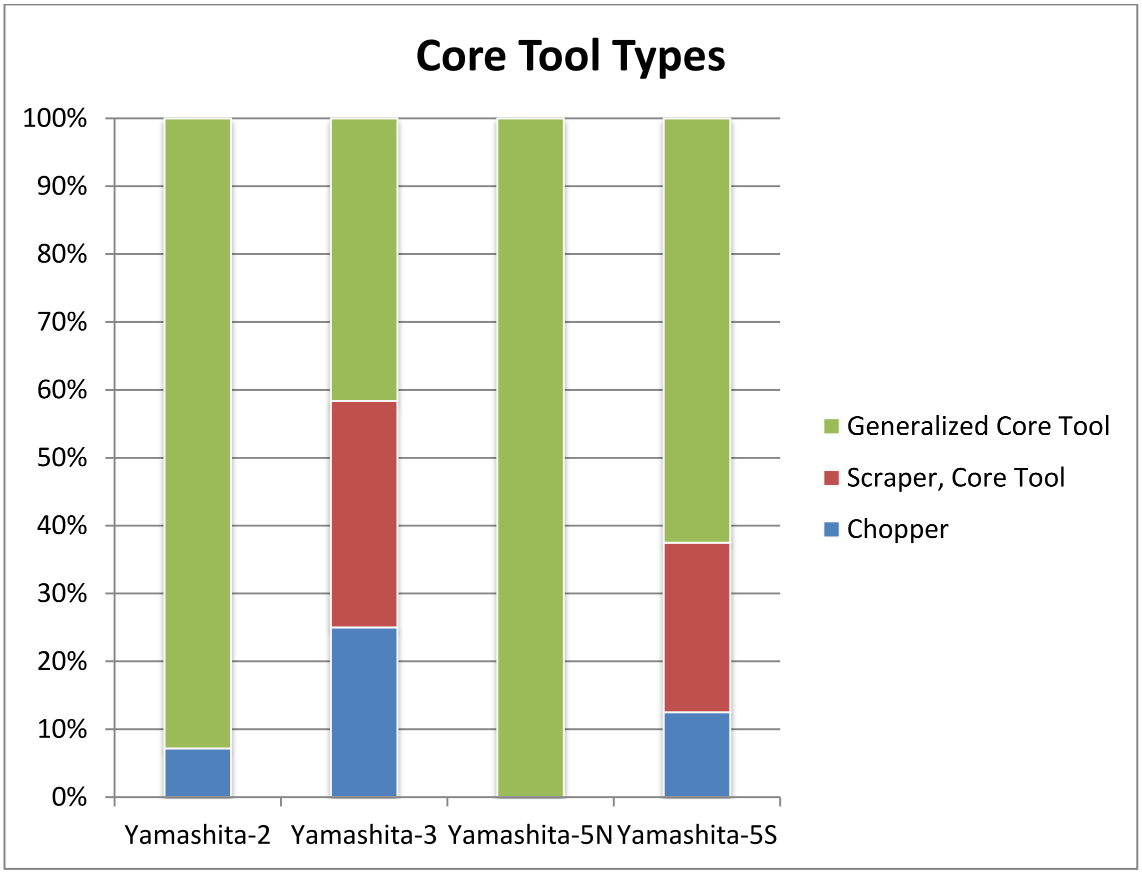

Figure 5.7 Percentages of core tool types across the sites.

They did not demonstrate any consistent standardized flaking pattern. As chopping and pounding implements, the ends of tools were manufactured primarily to create a sharp, durable edge with predominantly convex edge shapes. An increase in the standardization of core tool flaking patterns was noted at Yamashita-3, with core tools exhibiting scraper edges and standard chopper flake removal patterns at greater rates, with 30% of the core tools exhibiting scraper edges, suggesting a chopping activity becoming more frequent during this time. Core tools, however, did not account for a large proportion of any of the assemblages. Less than 10% of the chipped stone from all the Yamashita sites were core tools, indicating that activities that necessitated heavy chipped stone implements were not emphasized at any of the sites.

Cores

The core types identified at these sites included: tested; exhausted; multidirectional; and unidirectional. Cores recovered from the sites included: 21 cores from Yamashita-2, 22 from Yamashita-3, 2 from Yamashita-5N, and 4 from Yamashita-5S. The largest number of cores found at Yamashita-2 (n=19; 90%) and Yamashita-3 (n=15; 68%) were multidirectional cores and the only cores found at Yamashita-5S were multidirectional (Table 5.9) (Figure 5.8). At Yamashita-5N, two chert cores were recovered, both of which were exhausted and small in size, but which similarly exhibited random flaking patterns. Compared to other types of flake removal of cores, multidirectional flaking in cores generally represents more waste of raw material than standardized flaking patterns (i.e. bipolar, unidirectional). The low core counts at the sites were unusual as core to biface ratio rates generally increase with sedentism (Bamforth and Becker 2000).

Table 5.9 Core type across the sites.

	Yamashita -2		Yamashita -3		Yamashita -5N		Yamashita -5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Multi-directional	19	90	15	68	0	0	4	100	**38**
Uni-directional	0	0	0	0	0	0	0	0	**5**
Tested	2	10	3	14	0	0	0	0	**0**
Exhausted	0	0	4	18	2	100	0	0	**6**
TOTAL	**21**	**100**	**22**	**100**	**2**	**100**	**4**	**100**	**49**

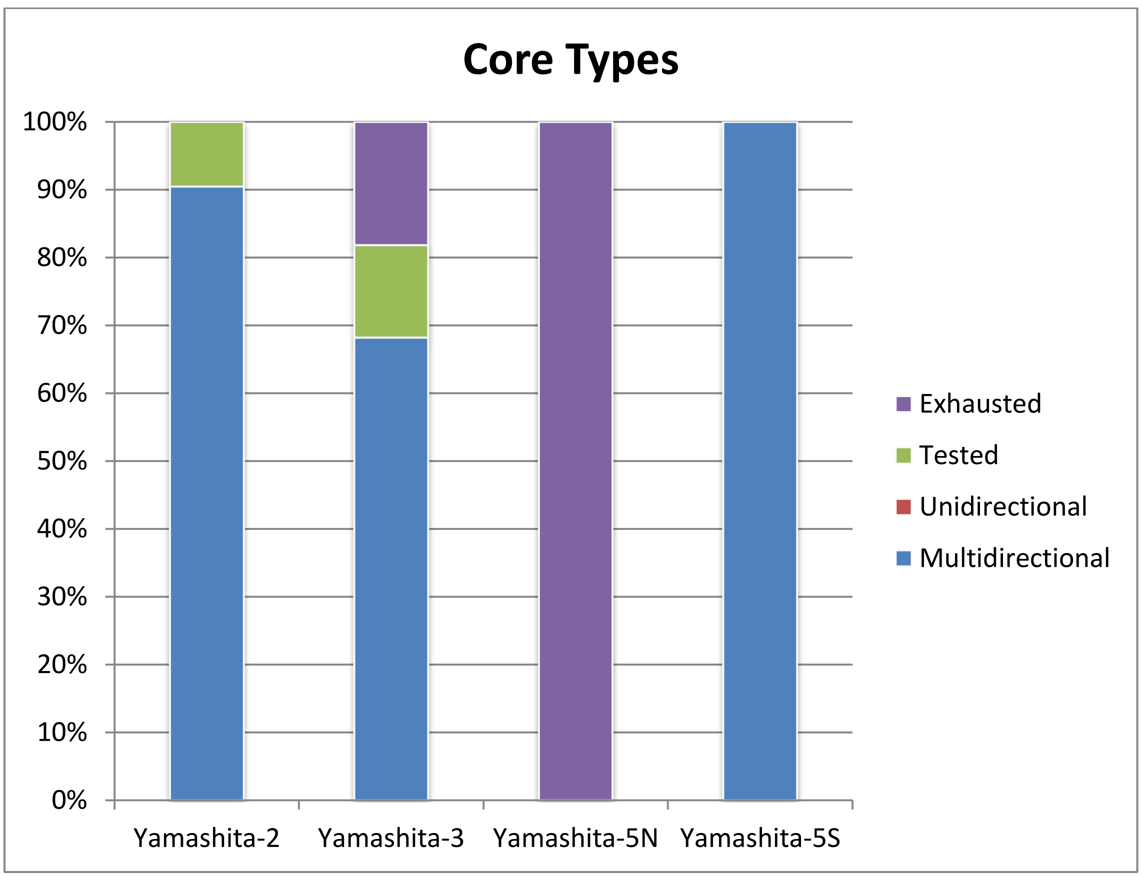

Figure 5.8 Percentages of core types across the sites.

The small number of cores at the sites indicated that early-stage core reduction did not frequently occur on-site and was instead done off-site, likely at quarry sites. Core flaking patterns also suggested a lack of raw material conservation across all sites. This is somewhat in contradiction to the higher rate of formal biface technology.

The remaining cortex was measured on the cores. The great variability of the cortex remaining on the cores across the sites suggested that there was likely no deliberate technological choice to remove or keep cortex on cores. The cortex remaining on the cores at Yamashita-2 suggested a preference toward some cortex removal (1 – 40%) at 52% (n=10) (Table 5.10; Figure 5.9). Yet, Yamashita-3 had nearly equal proportions of cores with complete cortex removal (n=6) (32%), some cortex (n=6) (29%), and nearly the entire cortex intact (n=7) (37%). The random removal of the cortex of cores showed that no focus was given to raw material conservation of cores and that informal core reduction predominantly occurred at the sites.

Table 5.10 Cortex remaining on cores across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
0%	6	32	6	32	2	100	0	0	**14**
1 – 40%	10	52	5	26	0	0	0	0	**15**
41 – 60%	2	11	1	5	0	0	3	75	**6**
61- 99%	1	5	7	37	0	0	1	25	**9**
TOTAL	**19**	**100**	**19**	**100**	**2**	**100**	**4**	**100**	**44**

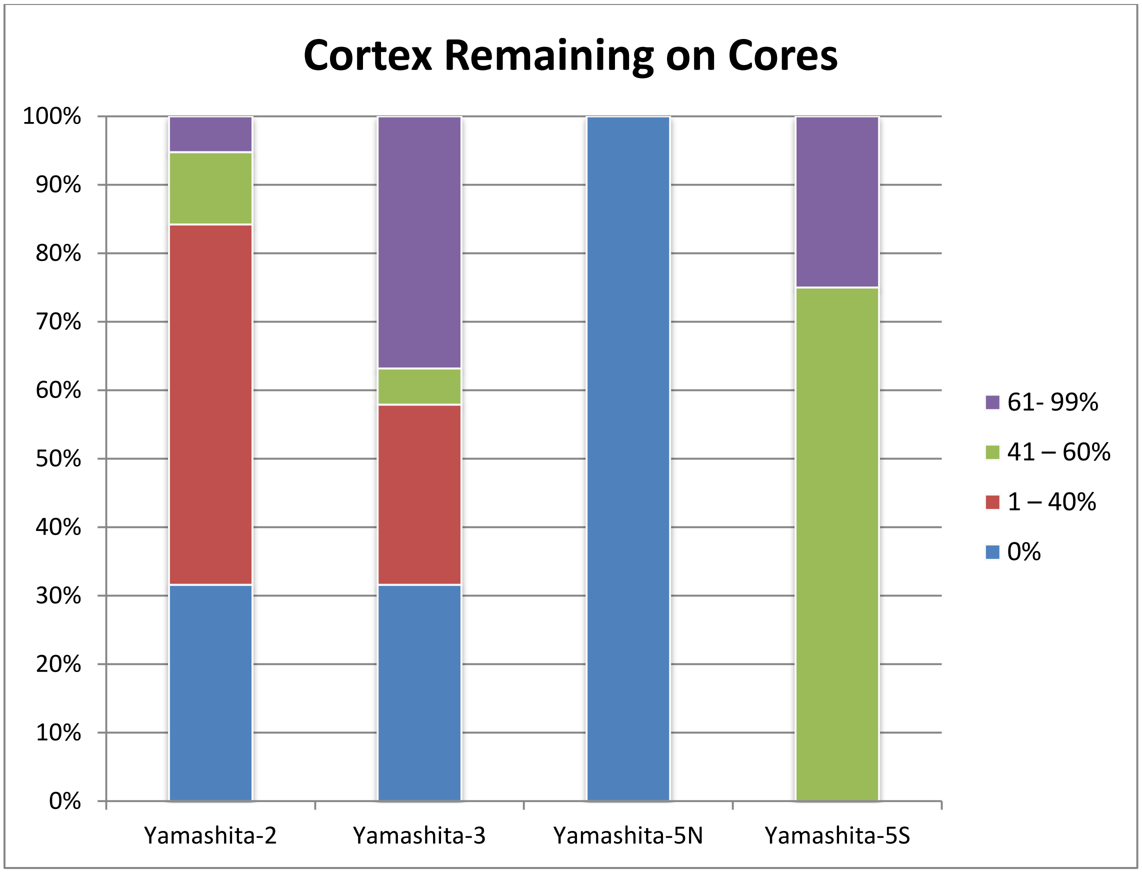

Figure 5.9 Cortex remaining on cores across the sites.

Debitage

In total, 3,630 pieces of debitage from across the sites were analyzed (Table 5.11; Figure 5.10). The sites all had high proportions of microflakes. Of the overall debitage counts, microflakes accounted for 20% (n=156) at Yamashita-2, 41% (n=843) at Yamashita-3, 40% (n=102) at Yamashita-5N, and 31% (n=151) at Yamashita-5S, which would suggest regular patterns of tool production and tool maintenance. The proportion increase in the debitage from Yamashita-3 possibly indicated that these activities occurred more often than at Yamashita-2. The small proportions of debris (or shatter) also indicated that hard-hammer percussion was not occurring regularly at the sites in comparison to the soft-hammer techniques that produced the smaller microflakes as debris accounted for only 4% (n=32) at Yamashita-2, 2% (n=46) at Yamashita-3, 0 %(n=0) at Yamashita-5N, and 13% (n=151) at Yamashita-5S. The type of debitage recovered from the sites, indicating that early-stage reduction techniques did not occur often at the sites, support the core data. While the numbers of debitage analyzed was not consistent across the sites, patterns in the data suggested that the lithic reduction strategies occurring at the sites remained relatively stable and were geared toward late-stage reduction strategies.

Table 5.11 Debitage condition across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Complete	123	15	285	14	30	12	61	12	**499**
Fragment	356	44	515	25	59	24	127	26	**1,057**
Proximal	139	17	391	18	59	24	90	18	**679**
Debris	32	4	46	2	0	0	65	13	**143**
Micro-flake	156	20	843	41	102	40	151	31	**1,252**
TOTAL	**806**	**100**	**2,080**	**100**	**250**	**100**	**494**	**100**	**3,630**

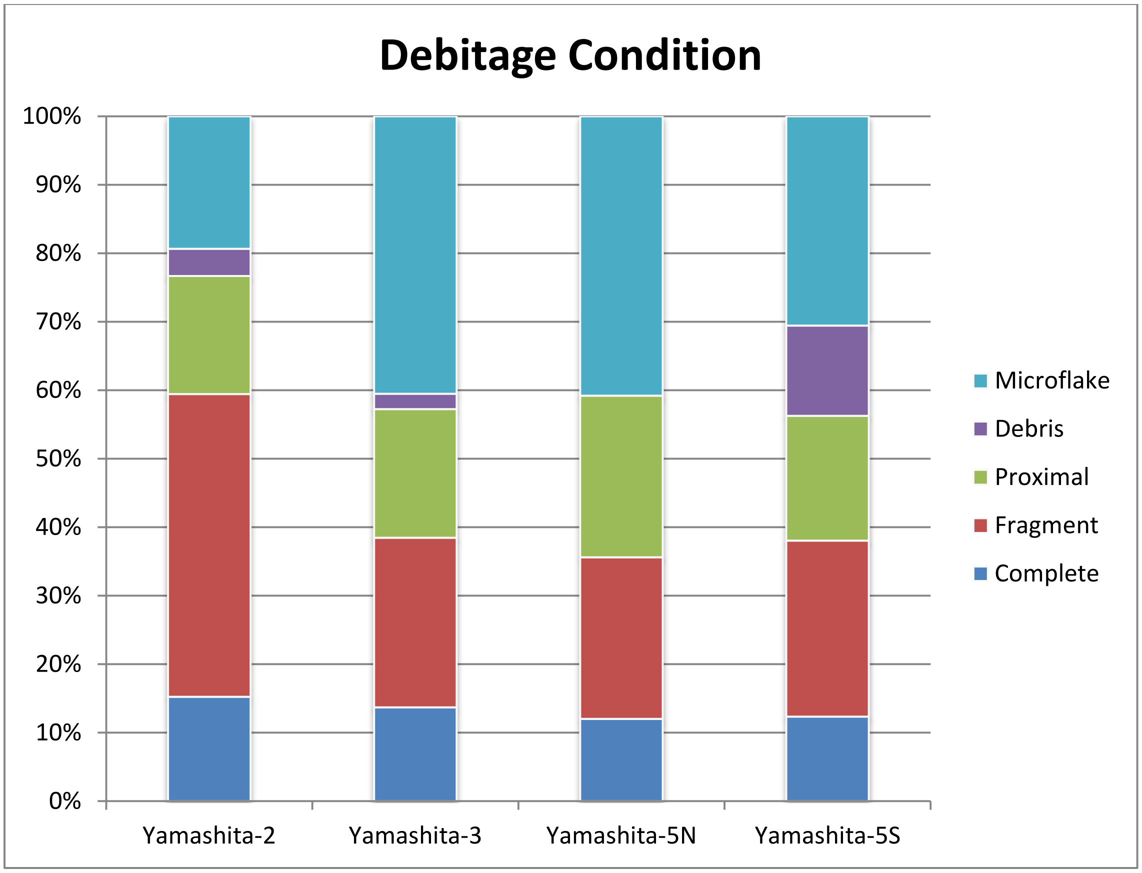

Figure 5.10 Percentages of debitage condition across the sites.

Size class was also assessed to understand methods of tool production to further understand how tool design related to tool function (Table 5.12; Figure 5.11). Size class of complete flakes also indicated that late-stage and retouch techniques were occurring more frequently than was early-stage core reduction. Debitage was heavily skewed toward smaller flakes (under 10 mm), accounting for 42% (n=52) at Yamashita-2, 65% (n=185) at Yamashita-3, 43% (n=13) at Yamashita-5N, and 43% (n=26) at Yamashita-5S. The second largest category contained those flakes clustered in the 10 mm to 20 mm group. Few flakes were found to be greater in length than 40 mm (3% (n=4) at Yamashita-2, 3% (n=8) at Yamashita-3, 10% (n=3) at Yamashita-5N, and 3% (n=2) at

Yamashita-5S), further indicating that early stages of core reductions were very limited at the sites.

Table 5.12 Size class (mm) of complete flakes across the sites.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Under 10	52	42	185	65	13	43	26	43	**276**
10 to 20	45	37	54	19	6	20	19	31	**124**
20 to 40	22	18	38	13	8	27	14	23	**82**
Over 40	4	3	8	3	3	10	2	3	**17**
TOTAL	**123**	**100**	**285**	**100**	**30**	**100**	**61**	**100**	**499**

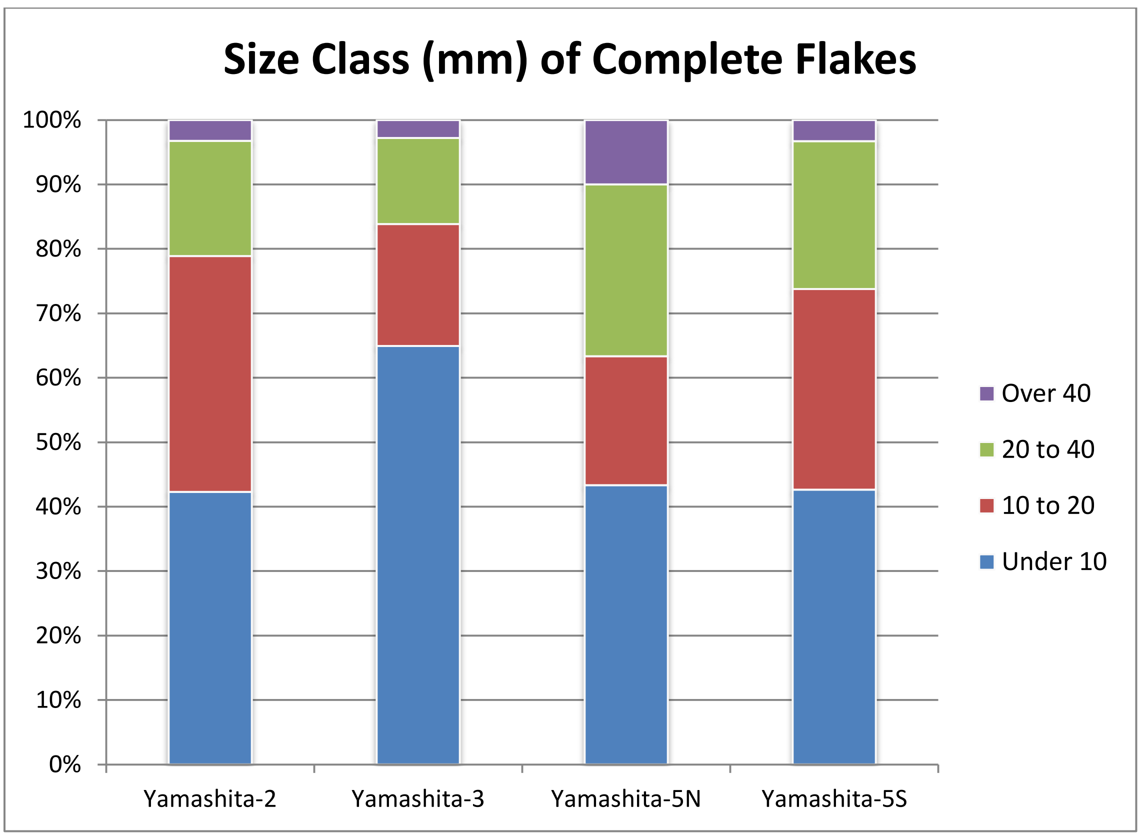

Figure 5.11 Size class (mm) of complete flakes across the sites.

The types of debitage platforms usually can indicate the type of core reduction occurring at a site. For example, a correlation has been noted between debitage platform type, platform preparation, and the stage of reduction (Gilreath 1984). Platform preparation is also usually done in the form of trimming or grinding in later stages of production to provide increased control of removal during knapping to reduce the risk of error and breakage (Andrefsky 2005). This method of control in flintknapping did not appear to have been utilized extensively at the sites. With the exception of Yamashita-3, the highest proportion of platform types identified on flakes was plain platforms, accounting for 44% (n=114) of Yamashita-2, 40% (n=269) of Yamashita-3, 57% (n=51) of Yamashita-5N, and 60% (n=90) of Yamashita-5S (Table 5.13; Figure 5.12). Crushed and absent platforms were the second most common platform type at all of the sites, accounting for 33% (n=86) at Yamashita-2, 41% (n=277) at Yamashita-3, 19% (n=19) at Yamashita-5N, and 22% (n=34) at Yamashita-5S indicative of hard-hammer percussion. Faceted platforms were less common than plain and crushed/absent platforms, accounting for 12% (n=32) at Yamashita-2, 13% (n=89) at Yamashita-3, 11% (n=10) at Yamashita-5N, and 11% (n=16) at Yamashita-5S. Platform data however did support the lack of the earliest stages of core reduction on- site, as cortical platforms were the least common platform types at the sites.

Platform data on the debitage ran contradictory to expectations across all the Yamashita sites if soft-hammer percussion was used to produce these flakes. However, while platform data can be used to infer the core reduction strategies occurring on site, experimental data have also suggested that the debitage attributes were not consistent across different knappers. This may suggest that debitage variability is not simply related to the kind of technology or the kinds of tools or cores used at sites (Williams and Andrefsky 2011). Platform data may also have produced these results as platform data from microflakes was not incorporated. The microflake assemblage was too large in number and too small in size for identification of platform preparation on each fragment with the unaided eye. It was therefore decided to focus analytical time on more data-rich lithics. It may be that platform preparation was more common on the microflakes found across the sites and this data was not captured during analysis.

Table 5.13 Debitage platform type (of complete and proximal flakes) across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Plain	114	44	269	40	51	57	90	60	**524**
Cortical	30	11	41	6	11	13	11	7	**93**
Crushed /Absent	86	33	277	41	17	19	34	22	**414**
Faceted	32	12	89	13	10	11	16	11	**147**
TOTAL	**262**	**100**	**676**	**100**	**89**	**100**	**151**	**100**	**1,178**

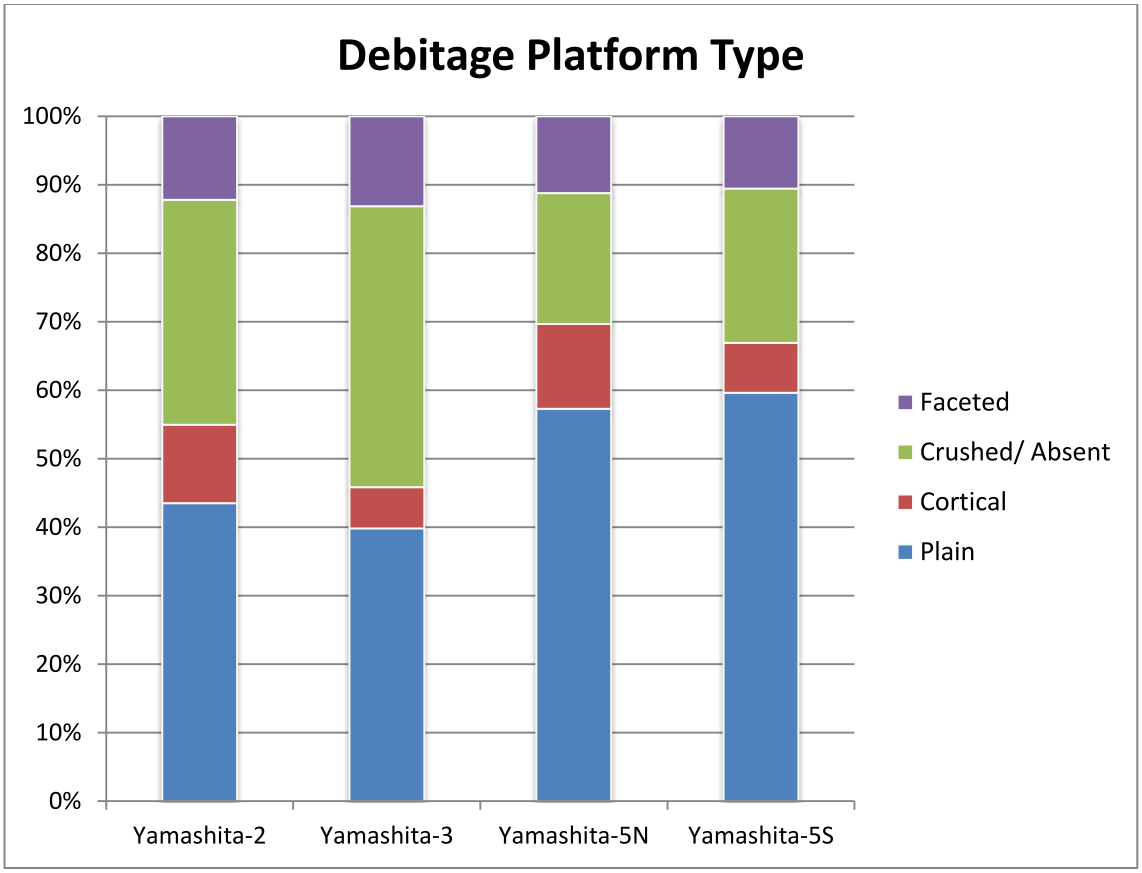

Figure 5.12 Percentages of debitage platform type across the sites.

Raw Material Use

Table 5.14 lists the types of raw material and the proportions found at the Yamashita sites. Across all of the sites, chert accounted for the majority of the chipped stone tool assemblages: 88% (n=300) at Yamashita-2, 87% (n=209) Yamashita-3, 88% (n=15) at Yamashita-5N, and 82% (n=26) at Yamashita-5S. Following chert, in much less substantial numbers, was obsidian, which accounted for 5% (n=16) of Yamashita-2, 5% (n=16) of Yamashita-3, 6% (n=1) of Yamashita-5N, and 1% (n=1) of Yamashita-5S. Other raw materials identified included: chalcedony, quartzite, sandstone, rhyolite, limestone, and diorite. These raw materials are found in much smaller quantities than chert.

Table 5.14 Total raw material breakdown across the sites.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	300	88	209	86	15	88	26	82	**550**
Chalcedony	9	3	10	4	0	0	1	3	**20**
Quartzite	5	1	5	2	0	0	1	3	**11**
Obsidian	16	5	12	5	1	6	1	3	**30**
Sandstone	1	1	0	0	0	0	0	0	**1**
Rhyolite	5	1	2	1	0	0	0	0	**7**
Diorite	0	0	0	0	0	0	1	3	**1**
Limestone	4	1	6	2	1	6	2	6	**13**
TOTAL	**340**	**100**	**244**	**100**	**17**	**100**	**32**	**100**	**633**

The preference for chert indicated that the locally-available material was heavily used in tool production (Figure 5.13). Coarser-grained toolstone, including quartzite, limestone, rhyolite, and sandstone, accounted for small proportions of the assemblages. The reasons for this were likely two-fold. First, the finer-grained chert was locally available and readily accessible. Second, the smaller contributions of other raw materials were likely the result of the type of tools predominantly being manufactured and in used at these sites (see Table 5.1). With the chipped stone assemblages heavily emphasizing biface technology, these tools would have been geared toward particular activities that generally utilized finer-grained materials.

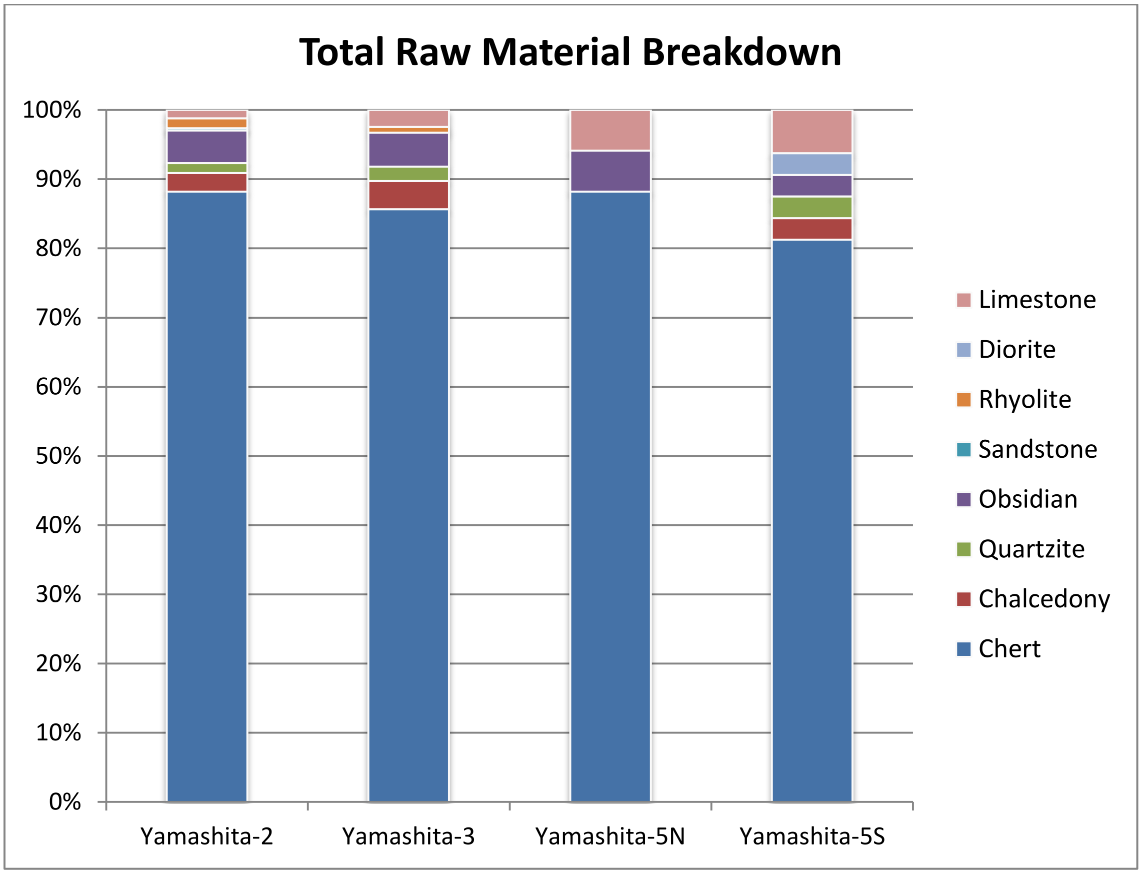

Figure 5.13 Total raw material breakdown across the sites.

To further understand how raw material was used at the Yamashita sites and if any differences in the use of raw material for specific tool types was evident, the tool types were further broken down to examine the differences in raw material selection (Tables 5.15 – 5.21). To guide discussion, raw material distribution was separated by general biface tools (unhafted bifaces, drills, and knives), projectile points, unifaces, core tools, cores, and debitage.

Biface Tools

Biface tools (Table 5.15 and Figure 5.14) included unhafted bifaces, drills, and knives. The distributions showed a clear preference toward chert and accounted for high proportions of the raw material distribution of these tool types: 88% (n=170) at Yamashita-2, 89% (n=113) at Yamashita-3, 100% (n=6) at Yamashita-5N, and 82% (n=9) at Yamashita-5S. A higher proportion of obsidian was noted in the use of bifacial tools from Yamashita-5S, yet given its smaller assemblage, this was more than likely a result of sample size than a representation of proportional differences in raw material use within this tool class. Quartzite, rhyolite, and limestone was also present within these tool types, but were limited to unhafted bifaces and drills at Yamashita-2 (n=5) and Yamashita-3 (n=1). Their rarity in these tool classes indicated that CCS was preferred because it provided a sharp edge to accomplish tasks. The few instances of these other materials were likely opportunistic use of these raw materials.

Table 5.15 Raw material distribution of bifacial tools across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	170	88	113	89	6	100	9	82	**298**
Chalcedony	6	3	7	6	0	0	1	9	**14**
Quartzite	1	<1	3	2	0	0	0	0	**4**
Obsidian	11	6	4	3	0	0	1	9	**16**
Sandstone	0	0	0	0	0	0	0	0	**0**
Rhyolite	4	2	0	0	0	0	0	0	**4**
Diorite	0	0	0	0	0	0	0	0	**0**
Limestone	1	<1	0	0	0	0	0	0	**1**
TOTAL	**193**	**100**	**127**	**100**	**6**	**100**	**11**	**100**	**337**

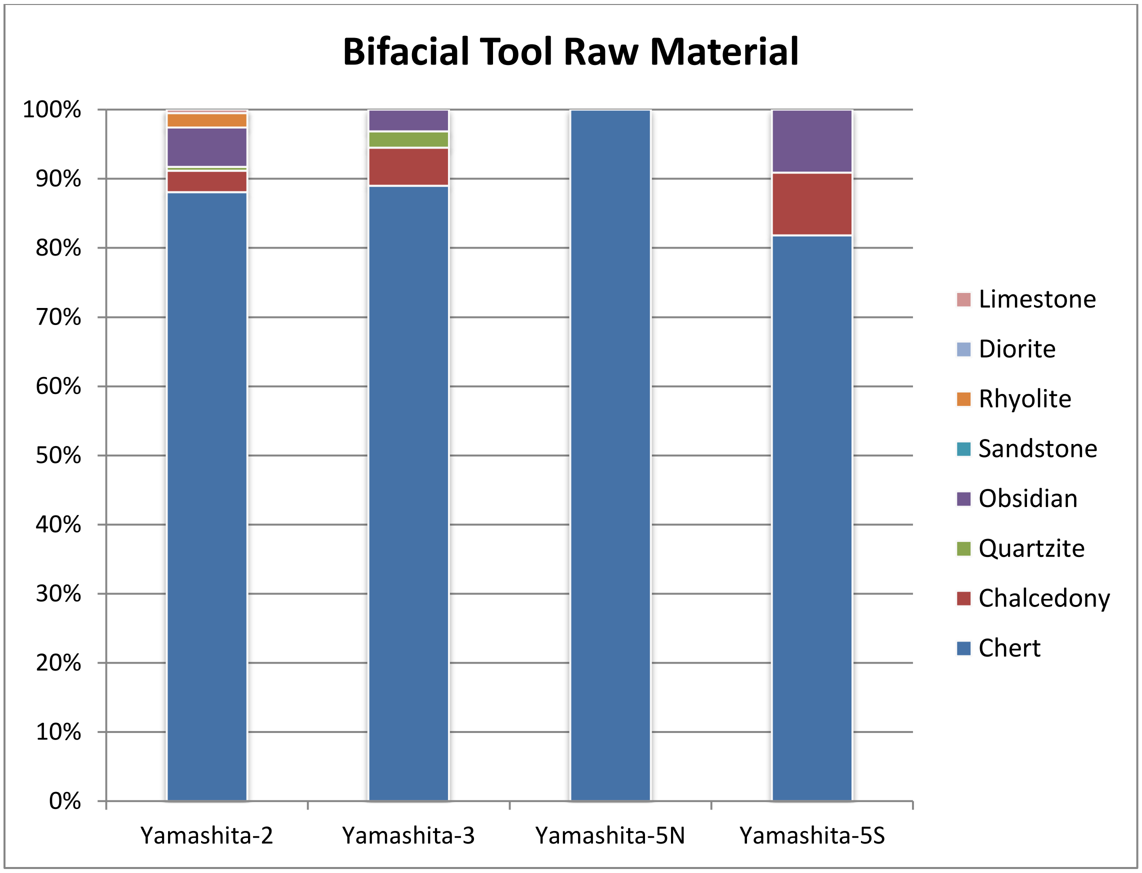

Figure 5.14 Percentages of raw materials used for bifacial tools across the sites.

Projectile Points

Similar to the other biface tools in the assemblages, projectile points across the sites were made primarily of chert and chalcedony, accounting for 93% (n=84) at Yamashita-2; 87% (n=69) at Yamashita-3; 86% (n=6) at Yamashita-5N; and 100% (n=13) at Yamashita-5S (Table 5.16; Figure 5.15). Obsidian accounted for only a small proportion of projectile points from each site: 5% (n=4) at Yamashita-2; 8% (n=6) at Yamashita-3; 10% (n=1) at Yamashita-5N; and 0% (n=0) at Yamashita-5S. The only instance of a projectile point made of a toolstone that was not CCS or obsidian was one

Table 5.16 Raw material distribution of projectile points across the sites.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	82	93	66	87	6	90	13	100	**167**
Chalcedony	2	2	3	4	0	0	0	0	**5**
Quartzite	0	0	1	1	0	0	0	0	**1**
Obsidian	4	5	6	8	1	10	0	0	**11**
Sandstone	0	0	0	0	0	0	0	0	**0**
Rhyolite	0	0	0	0	0	0	0	0	**0**
Diorite	0	0	0	0	0	0	0	0	**0**
Limestone	0	0	0	0	0	0	0	0	**0**
TOTAL	**88**	**100**	**76**	**100**	**7**	**100**	**13**	**100**	**184**

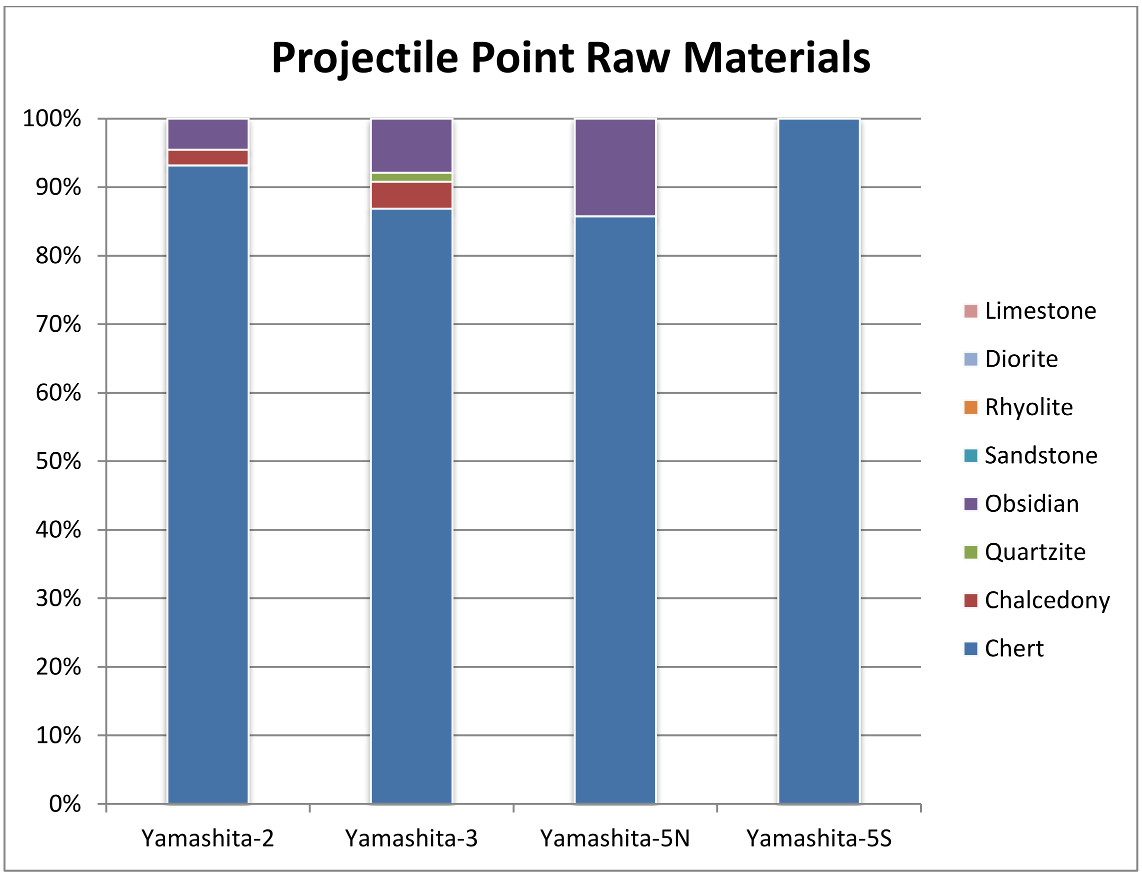

Figure 5.15 Percentages of raw materials used for projectile points across the sites.

discussed. The raw material distribution of the projectile points at the sites indicated that the high-quality CCS was heavily utilized in creating finished points. Obsidian was rare, but was the second most used raw material. This pattern was present at all of the sites, suggesting that obsidian was likely used in the production of projectile points when available, but was not preferentially treated.

Unifaces

Raw materials used to make unifaces were similar to the biface tools, with the greatest proportion of toolstone being chert (Table 5.17; Figure 5.16). Unifaces identified in the analysis were small flake tools or retouched flakes. Unifaces that are small flake tools generally tend to be made on coarser raw materials to create a more durable edge (Sliva 1997). However, the local availability of high- quality chert made it the preferred raw material for this tool class, accounting for 91% (n=40) at Yamashita-2, 93% (n=27) at Yamashita-3, and 100% (n=3) at Yamashita-5N. No unifaces were recovered from Yamashita-5S. Unifaces represent a small proportion of the tools recovered at the Yamashita sites, and seeking out coarser-grained, sturdier toolstone was not prioritized to accomplish these activities given that they were not frequent.

Table 5.17 Uniface raw material across the sites.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	40	91	27	93	3	100	0	0	**70**
Chalcedony	1	2	0	0	0	0	0	0	**1**
Quartzite	1	2	0	0	0	0	0	0	**1**
Obsidian	2	5	2	7	0	0	0	0	**4**
Sandstone	0	0	0	0	0	0	0	0	**0**
Rhyolite	0	0	0	0	0	0	0	0	**0**
Diorite	0	0	0	0	0	0	0	0	**0**
Limestone	0	0	0	0	0	0	0	0	**0**
TOTAL	**44**	**100**	**29**	**100**	**3**	**100**	**0**	**0**	**76**

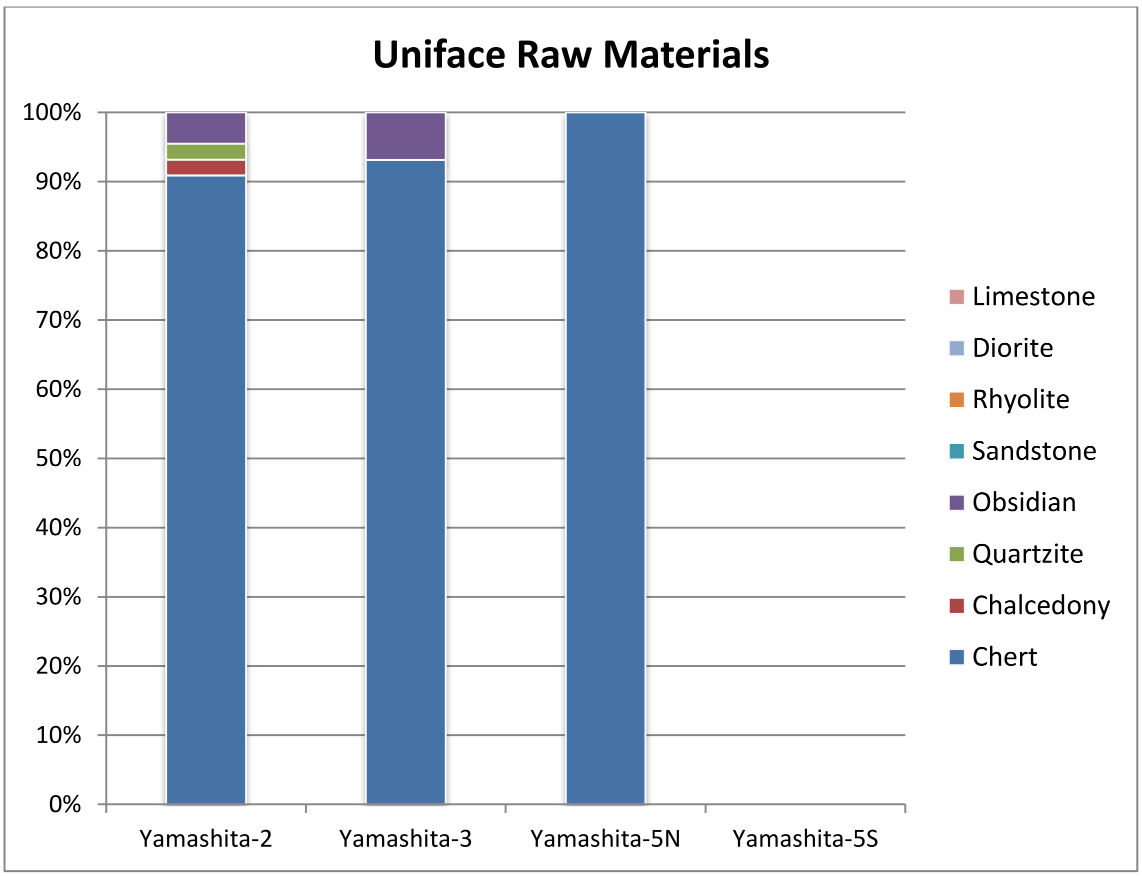

Figure 5.16 Percentages of raw materials used for unifacial tools across the sites.

Retouched flakes were also made primarily of chert. Chert accounted for 94% (n=34) of Yamashita-2's and 93% (n=26) of Yamashita-3's retouched flakes counts (Table 5.18; Figure 5.17). Yamashita-5N had only chert one retouched flake in its assemblage and Yamashita-5S had none. Retouched flakes were rarely produced on obsidian flakes. Retouched flakes did not appear to have been heavily utilized at the sites for activities. The limited number of retouched flakes at the sites indicated a lack of raw material conservation and little expedient technology.

Table 5.18 Raw material distribution of retouched flakes across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	34	94	26	93	1	100	0	0	**61**
Chalcedony	0	0	0	0	0	0	0	0	**0**
Quartzite	0	0	0	0	0	0	0	0	**0**
Obsidian	2	6	2	7	0	0	0	0	**4**
Sandstone	0	0	0	0	0	0	0	0	**0**
Rhyolite	0	0	0	0	0	0	0	0	**0**
Diorite	0	0	0	0	0	0	0	0	**0**
Limestone	0	0	0	0	0	0	0	0	**0**
TOTAL	**36**	**100**	**28**	**100**	**1**	**100**	**0**	**100**	**65**

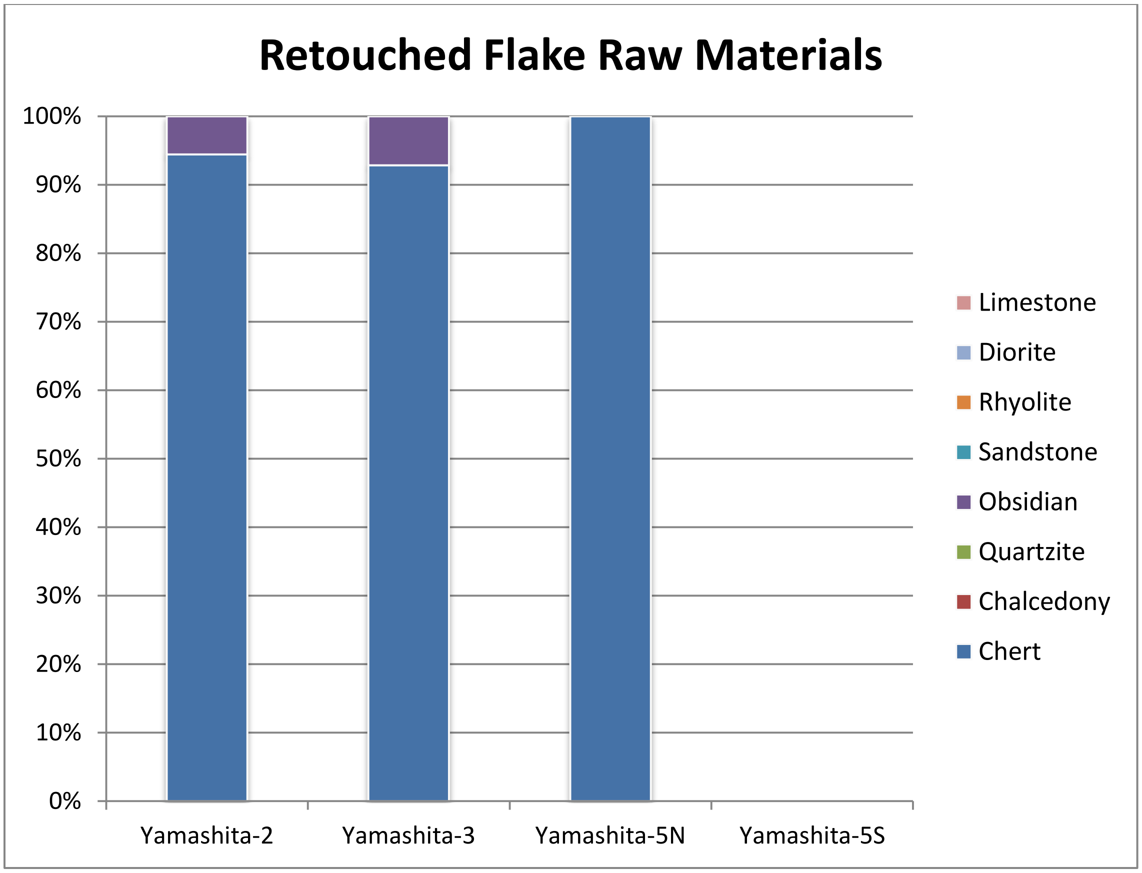

Figure 5.17 Percentages of raw materials used for retouched flakes across the sites.

Core Tools

Core tools had the greatest proportion of artifacts made of non-CCS raw materials (Table 5.19; Figure 5.18). Raw materials rarely seen or absent in the other tool classes were used for core tools and included the coarser-grained raw materials: quartzite, diorite, sandstone, and rhyolite. The most common raw material at the Yamashita sites was limestone, accounting for 36% (n=5) at Yamashita-2, 50% (n=6) at Yamashita-3, and 100% (n=1) at Yamashita-5N. Limestone also was present at Yamashita-5S but accounted for 25% (n=2). The most common toolstone at Yamashita-5S was chert. Chert core tools were also present at Yamashita-2 and Yamashita-3, accounting for 7% (n=1) and 25% (n=3). The limestone at these sites provided sharp, durable edges for heavy implements used during chopping activities. The use of this coarse-grained toolstone suggested that it would have performed differently for a particular task at hand, compared to the finer-grained CCS. Edge durability was important in the production of core tools at the Yamashita sites. However, given the abundance and availability of CCS, it was also used within this tool class, regardless of the coarser-grained raw materials outperforming it in edge durability.

Table 5.19 Core tool raw material across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	1	7	3	25	0	0	4	50	**8**
Chalcedony	0	0	0	0	0	0	0	0	**0**
Quartzite	3	21	1	8	0	0	1	12.5	**5**
Obsidian	0	0	0	0	0	0	0	0	**0**
Sandstone	1	7	0	0	0	0	0	0	**1**
Rhyolite	4	29	2	17	0	0	0	0	**6**
Diorite	0	0	0	0	0	0	1	12.5	**1**
Limestone	5	36	6	50	1	100	2	25	**14**
TOTAL	**14**	**100**	**12**	**100**	**1**	**100**	**8**	**100**	**35**

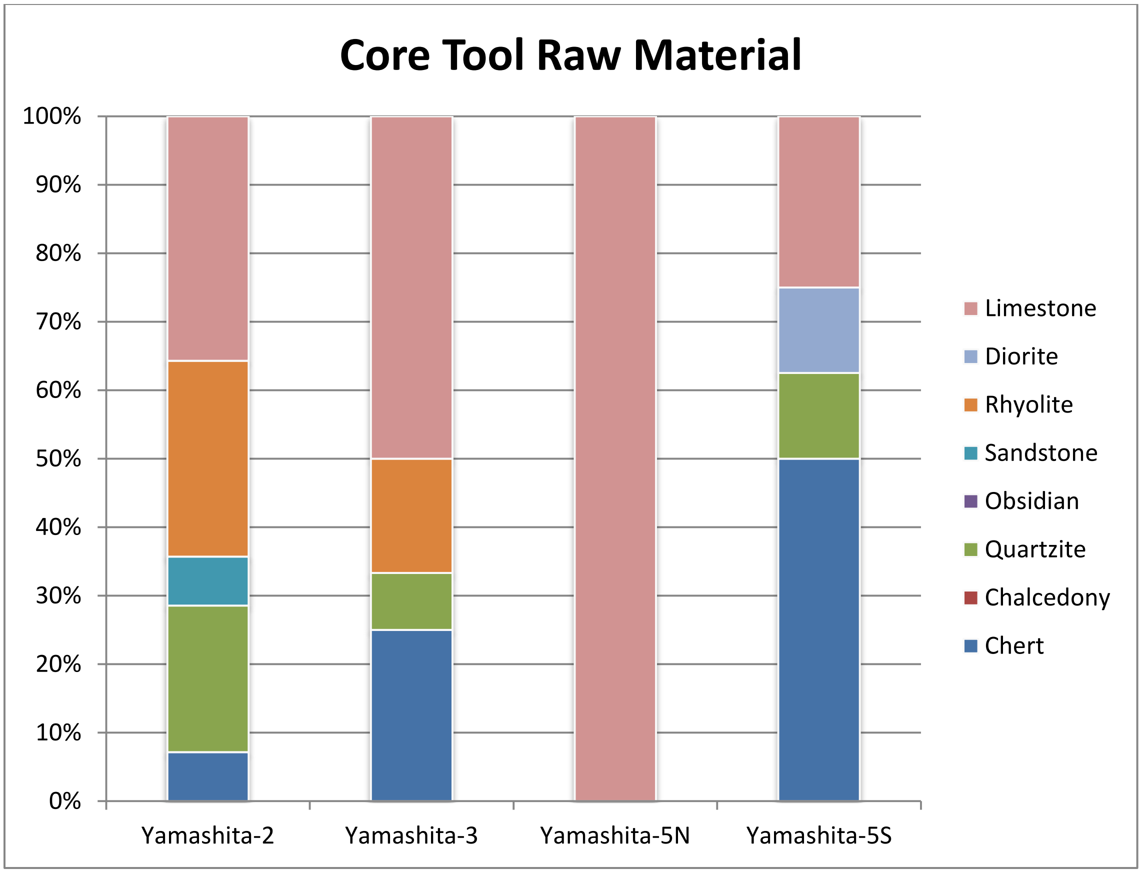

Figure 5.18 Percentages of raw materials used for core tools across the sites

Cores

Forty-four cores were found at the sites: 21 at Yamashita-2, 22 at Yamashita-3, 2 at Yamashita-5N, and 4 at Yamashita-5S (Table 5.20, Figure 5.19). The cores indicated that lithic strategies involving the earliest-stages of lithic reduction occurred, but the low number showed that it was not commonly conducted on-site. Cores were predominantly made of chert and other raw materials were limited. Chert accounted for 57% (n=12) of Yamashita-2, 64% (n=14) of Yamashita-3, 100% (n=2) of Yamashita-5N, and 25% (n=1) of Yamashita-5S. Obsidian was only present at Yamashita-2 and accounted for 14% (n=3) of the core assemblage. Rhyolite, limestone, and quartzite cores were present in small quantities in all of the sites except the Yamashita-5N sample. These proportions mirrored tool and debitage data on raw material use at the sites.

Table 5.20 Raw material distribution of cores across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Chert	12	57	14	64	2	100	1	25	**29**
Chalcedony	0	0	0	0	0	0	0	0	**0**
Quartzite	2	10	2	9	0	0	3	75	**7**
Obsidian	3	14	0	0	0	0	0	0	**3**
Sandstone	0	0	0	0	0	0	0	0	**0**
Rhyolite	1	5	2	9	0	0	0	0	**2**
Diorite	0	0	0	0	0	0	0	0	**0**
Limestone	3	14	4	18	0	0	0	0	**3**
TOTAL	**21**	**100**	**22**	**100**	**2**	**100**	**4**	**100**	**49**

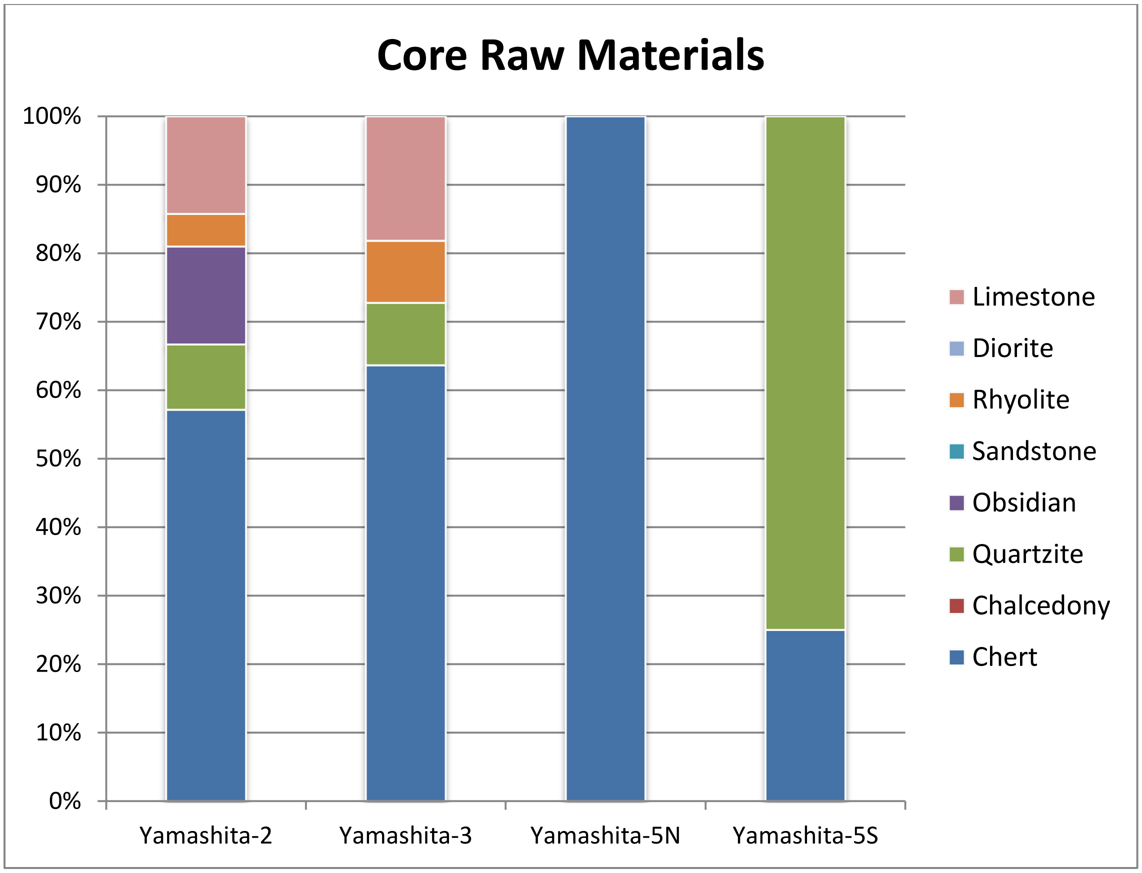

Figure 5.19 Percentages of raw materials used for cores across the sites.

Debitage

In total, 3,630 pieces of debitage from across the sites were analyzed (Table 5.21; Figure 5.20). The majority of the debitage from the sites were made from local CCS, with 71% (n=576) at Yamashita-2, 83% (n=1,729) at Yamashita-3, 91% (n=227) at Yamashita-5N, and 84% (n=415) at Yamashita-5S. Quartzite was the second most common raw material within all of the debitage assemblages with 18% (n=147) at Yamashita-2, 11% (n=234) at Yamashita-3, 9% (n=23) at Yamashita-5N, and 11% (n=56) at Yamashita-5S. Obsidian debitage data was consistent across the occupations, accounting for less than 5% at all of the sites except for Yamashita-5N, where it was absent. Other raw materials present in quantities less than 5% of the assemblage at each site included: sandstone, rhyolite, basalt, and limestone. This debitage data supplemented tool data which indicated that local CCS dominated all of the chipped stone used at the sites.

Table 5.21 Raw material distribution of debitage across the sites.

	Yamashita-2		**Yamashita-3**		**Yamashita-5N**		**Yamashita-5S**		**TOTAL**
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
CCS*	576	71	1,729	83	227	91	415	84	**2,947**
Quartzite	147	18	234	11	23	9	56	11	**460**
Obsidian	36	4	62	3	0	0	11	2	**109**
Sandstone	2	<1	6	<1	0	0	0	0	**8**
Rhyolite	22	3	17	1	0	0	9	2	**48**
Basalt	4	1	0	0	0	0	2	<1	**6**
Limestone	19	2	32	2	0	0	1	<1	**52**
TOTAL	**806**	**100**	**2,080**	**100**	**250**	**100**	**496**	**100**	**3,630**

*includes chert and chalcedony

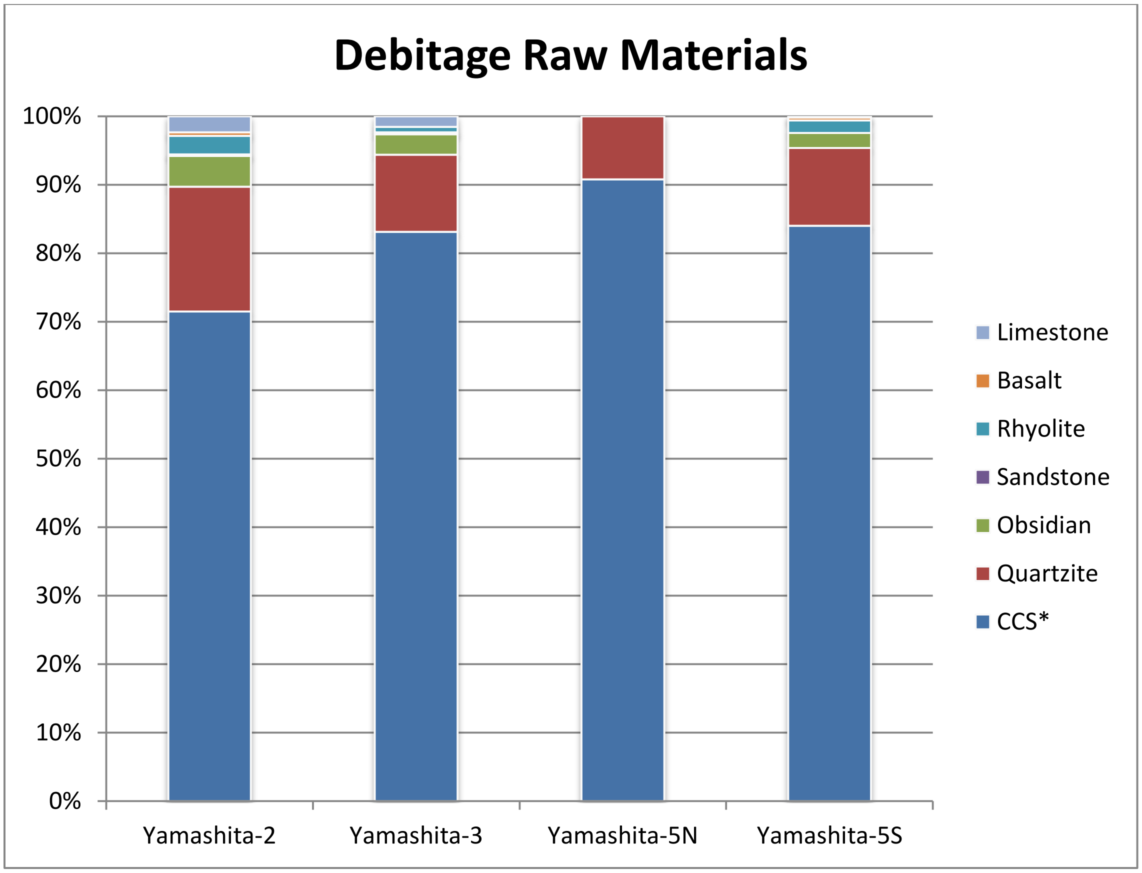

Figure 5.20 Percentages of raw materials of debitage across the sites.

Obsidian Sourcing

Obsidian sourcing offered additional insights into raw material availability and use. Obsidian is generally a high-quality raw material that is well-known to have been transported across significant distances in prehistory via trade and exchange. While it accounted for a small proportion of the raw material used at the sites, it represented the second most commonly used raw material. To further understand how obsidian was being brought into the sites, several obsidian pieces from different tool classes were sourced.

Previously, 12 projectile points from the Yamashita sites had been geochemically sourced by Dr. Margaret Lyneis as part of a larger sample for the Nellis Air Force Base

Regional Obsidian Sampling Study. These samples were not included in the final report (Haarklau et al. 2005). The previous projectile point study identified the Panaca Summit, Obsidian Butte, and several Kane Springs locales as sources for Yamashita obsidian toolstone (Lyneis n.d.). Seventeen additional artifacts were sent to Northwest Obsidian Research Laboratory for this thesis project. This sample included two projectile points, eleven flakes, two retouched flakes, two cores, and two nodules from across the sites. Though a small sample of specimens (n=17), five distinct obsidian sources were identified.

Sources identified in this study included two separate Kane Springs sources: Kane Springs Wash Caldera (Variety 1) and Kane Springs Wash Caldera (Variety 2). Other sources included: Modena, Wild Horse Canyon, and Coso (West Sugarloaf) (Table 5.22). The source of two artifacts could not be determined, but represented two different source locations. The scatterplot (Figure 5.21) shows the levels of strontium (Sr) vs. zirconium (Zr) of each artifact. The Yamashita artifacts mostly clustered into the two varieties of Kane Springs obsidian or were of Modena origin, all of which are located in Nevada, north of Moapa Valley. Wild Horse Canyon is located in the Mineral Mountains of Utah, northeast of the Moapa Valley. Coso (West Sugarloaf) is located in the Coso Volcanic Field located in California and was the farthest source identified in this study (Skinner 2012).

Table 5.22 Summary of results of trace element analysis of obsidian artifacts.

	Yamashita-2		Yamashita-3		Yamashita-5N		Yamashita-5S		TOTAL
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**	
Coso (West Sugarloaf)	0	0	1	16.5	0	0	0	0	**1**
Kane Springs Wash Caldera Variety 1	4	50	0	0	0	0	0	0	**4**
Kane Springs Wash Caldera Variety 2	2	25	2	34	0	0	2	0	**6**
Modena	1	12.5	1	16.5	0	0	1	0	**3**
Unknown 1	1	12.5	0	0	0	0	0	0	**1**
Unknown 2	0	0	1	16.5	0	0	0	0	**1**
Wild Horse Canyon	0	0	1	16.5	0	0	0	0	**1**
TOTAL	**8**	**100**	**6**	**100**	**0**	**0**	**3**	**100**	**17**

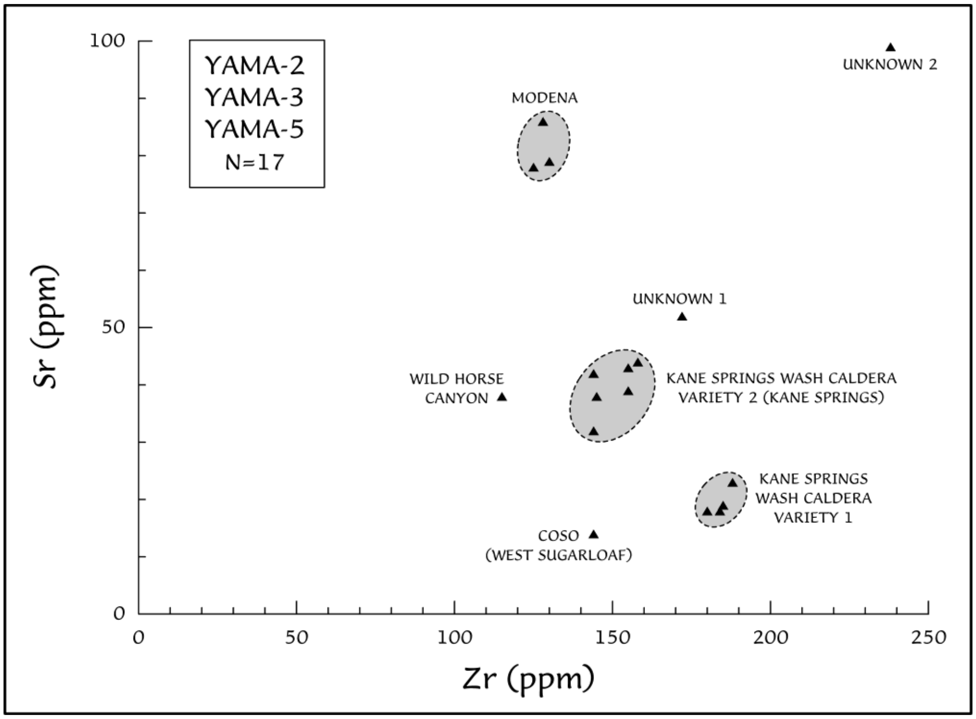

Figure 5.21 Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for all analyzed artifacts (Skinner 2012).

Yamashita-2 had three sources identified and one unknown: Kane Springs Caldera Variety 1, Kane Springs Caldera Variety 2, and Modena. Yamashita-3 had four identified: Coso (West Sugarloaf), Kane Springs Caldera Variety 2, Modena, and Wild Horse Canyon, and one unknown source. Yamashita-5S had two sources identified: Kane Springs Caldera Variety 2 and Modena. Artifact types are provided in Table 5.23.

At Yamashita-2, no differences in artifact forms were seen according to obsidian source. Kane Springs was the most commonly identified source with Varieties 1 and 2. Artifacts sourced from Kane Springs included a variety of artifacts ranging from a core, a finished projectile point, and several flakes. An additional source, Wild Horse Canyon, located in Utah, was identified at Yamashita-3 in the form of a Cottonwood projectile point. It is possible that this projectile point may have been traded into the area in its finished form. A nodule from Yamashita-3 could not be sourced to a known location.

Table 5.23 Artifact type by obsidian source.

Site	**Type**	**Source**
Yamashita-2	Flake	Kane Springs (Variety 1)
	Core	Kane Springs (Variety 1)
	Projectile point (Reworked)	Kane Springs (Variety 1)
	Flake	Kane Springs (Variety 2)
	Flake	Unknown 1
	Retouched Flake	Modena
	Flake	Kane Springs (Variety 2)
	Core	Kane Springs (Variety 1)
	Flake	Coso (West Sugarloaf)
	Nodule	Kane Springs (Variety 2)
Yamashita-3	Flake	Kane Springs (Variety 2)
	Flake	Modena
	Projectile point (Cottonwood)	Wild Horse Canyon
	Nodule	Unknown 2
	Retouched flake	Kane Springs (Variety 2)
Yamashita-5S	Flake	Kane Springs (Variety 2)
	Flake	Modena

Artifacts from Yamashita-5S were sourced to Kane Springs and Modena. Across the sites, Kane Springs was the most common source of obsidian across all of the occupations. However, obsidian cores were only present at Yamashita-2. Given Kane Springs proximity to Moapa Valley, obsidian was probably collected from gravels washed down from the source area (Allen 1999). It is also possible that obsidian was collected using direct procurement strategies as initial-stage nodules and cores and then underwent the full-range of reduction at Yamashita-2. The lack of obsidian cores and the absence of Kane Springs (Variety 1) as a source of artifacts at Yamashita-3 and Yamashita-5S may suggest that this source was abandoned after Yamashita-2 in favor of other sources.

Summary

The chipped stone assemblages of the Yamashita sites showed continuity in tool design and raw material use throughout all of the occupations. The chipped stone assemblages were unusual with regard to the tool technological practices and theoretical expectations. The Yamashita sites were sedentary, residential sites. Residential sites that are focused on agricultural activities generally focus tool production on expedient technology (Parry and Kelly 1987; Andrefsky 1994a), but at the Yamashita sites, formal biface technology was disproportionately higher. This formal biface technology was seen through the large numbers of unhafted bifaces and projectile points, which collectively constituted more than 70% of each site's chipped stone tool assemblages. These formal tools emphasized a tool design system that favored maintainability and reliability. Toolkits that favor maintainability and reliability are more similar to hunting and gathering groups, rather than sedentary groups with agricultural foci. This suggests that the inhabitants of the Yamashita sites did not produce their chipped stone tool technology in typical and expected ways.

The predominant numbers of biface technology would suggest specific activities to the Yamashita sites. Their numbers in comparison to other tools at the sites showed that the biface tool acted as a general purpose cutting tool, likely for plant processing of cultigens and various weedy plants, along with hunting. For example, Harry and Watson tested pollen and macrobotanical remains from House 20 at Lost City and this provides a useful analogue to the Yamashita sites as a comparable VBP site in the Moapa Valley with a radiocarbon date of AD 1010 – 1270 (Harry and Watson 2010). They showed that Puebloan inhabitants focused on a mixed subsistence strategy of locally available flora and fauna. Bighorn sheep and rabbits dominated their faunal counts and maize dominated macrobotanical remains counts. Various non-cultivated floral remains were recovered as well, dominated by weedy plants of *Sesuvium* and *Poaceae* (2010:416) Around the Yamashita sites dominant vegetation would have been creosote bush, bursage cholla and prickly pear on Sand Bench. Those living at the sites also would have had the adjacent Muddy River floodplain for growing maize and gathering other foods including cattail. Yamashita-3 had macrobotanical remains indicating the presence of cholla and cattail alongside maize. It is possible bifaces were used for processing some of these plants. The recovery of other tools including drills, unifaces, and core tools demonstrated that other activities including boring and chopping occurred at the sites, but at much smaller frequencies.

The Yamashita sites were also somewhat unusual due to the somewhat contradictory data related to raw material use. Bamforth (1994) has noted that when abundant raw material is available, there are generally low levels of raw material conservation. Local CCS in the area was abundant, available, and accounted for a disproportionately high rate of raw material at the sites.

Low levels of raw material conservation occurred at the Yamashita sites as would be expected as noted through the core and debitage data. Yet, the chipped stone assemblages consisted mostly of formal biface technology. Formal biface technology is generally produced and maintained in order to conserve raw material. The biface technology at the sites did not show high rates of resharpening, which would have been expected if raw material was being conserved. The disproportionate amount of biface technology and the low rates of conservation at all the sites were unexpected and somewhat in contradiction with one another. However, the proportions are maintained throughout the various site occupations, indicating that the chipped stone assemblages were specifically organized to favor biface technology.

CHAPTER 6

CONCLUSIONS

The chipped stone assemblages from the Yamashita sites yielded results in response to the theoretical concerns addressed in this thesis. The theoretical orientation suggested that lithic technology is organized with technological strategies in mind during the stages of acquisition, manufacture, re-use, and discard (Nelson 1991). According to a technological organization framework, technological strategies should be visible in the archaeological record through identification of tool design and an assessment of social and environmental conditions, specifically settlement patterns and raw material availability. At the Yamashita sites, any change in the technological strategies would have resulted in differences in tool design, tool form quantities in the assemblages, raw material preference, and retouch levels. The results from the Yamashita sites showed little change to organization of technology over time.

Research Questions

1. **What do the tools and debitage reveal concerning tool design at the Yamashita Sites? How does tool design relate to tool function? Are any changes in tool design apparent over time?**

The tools and debitage from the Yamashita sites revealed a clear preference in tool design for formalized bifacial technology, with little evidence of expedient technology. Unhafted bifaces dominated the assemblages and suggest that specialization in tool design was not common. Unhafted bifaces likely acted as general, multipurpose tools. Specific tasks that necessitated a particular tool design and tool form, such as a drilling or a heavy pounding, were comparatively limited in all of the site assemblages.

The second most common tool type was projectile points. Projectile points span from early bow-and-arrow technology series such as Rosegate to later Desert Side-Notched and Cottonwood Triangular points. The later points are generally smaller in size and exhibit different morphologies than the earlier points. No clear seriation of the point types between sites was identified and admixture was common. Examination of projectile points showed that two bifacial flaking techniques were used to manufacture projectile points. One was percussion-based and was used for shaping and bifacial thinning, which was then followed by pressure-retouch flaking and the second technique consisted of pressure shaping a thin flake. This latter technique may have been a technological strategy implemented with greater frequency later in time on smaller points.

Several other differences in tool design were noted across the sites. The numbers of drills and knives between the early Pueblo II site, Yamashita-2, and the later Pueblo II site, Yamashita-3, indicated a decrease in drill design and an increase in knife design over time. This suggested less evidence of perforating and punching tool activities later in this period than in the early Pueblo II period. Additionally, the number of scrapers and denticulates decreased fromYamashita-2 to Yamashita-3. An increase in knife design at Yamashita-3 may have fulfilled the tool function of these tools at Yamashita-3. It may also have represented a separate stage in a biface's use-life The number of core tools was similar between all occupations. Core tools exhibited the greatest variability in tool design and their function as pounding implements was likely not directly linked with a standardized worked edge.

Cores were limited in the assemblages. They occur commonly enough to indicate at least some core-reduction activities, but the large quantity of late-stage debitage seen throughout the sites suggest thinning and retouch activities occurred more frequently. Additionally, the debitage at the sites revealed that early-stage reduction of CCS, as evidenced through decortication and secondary flakes, did not occur extensively at any of the sites. This toolstone was likely brought into the sites more often as formalized biface technology. Debitage revealed patterns of retouch activities to maintain these formal tools.

The Yamashita sites therefore have chipped stone assemblages that have low core counts and are predominantly comprised of unhafted bifaces and projectile points. Manufacture and tool retouch occurred at the sites and are primarily geared toward these tool types. Thus, these tool types would have acted as maintainable tools in low tool diversity site assemblages. This is uncommon at sedentary sites (Parry and Kelly 1987; Bamforth and Becker 2000) and reflects technological strategies of tool production more reminiscent of hunting and gathering populations. Looking at other VBP sites in the area, the chipped stone assemblages of the Yamashita sites still contain disproportionately high numbers of bifaces.

2. What do the tools and debitage reveal concerning how raw materials were used at the Yamashita Sites? Were different raw materials used for specific tool types? Did raw material use change over time?

The tools and debitage at the Yamashita sites demonstrated that the local toolstone-rich environment heavily impacted the chipped stone assemblages. As has been noted by Andrefsky (1994a, 1994b), when locally available lithic materials are easily accessible and abundant, they tend to be used for all types of chipped stone tools and activities. The abundance of toolstone is evident at all of the Yamashita sites in the form of CCS. Abundance is tied to the presence of available raw material in the vicinity. CCS is known to occur as cobbles on the floodplain and at sources on Mormon Mesa.

CCS represents over 90% of all toolstone at the sites, a percentage that is consistent with other VBP collections in the valley (see Lyneis et al. 1989, Myhrer 1989; Shutler 1961).The exception to the ubiquitous use of CCS toolstone is in the core tools. Because of the function of core tools, the properties of CCS are not well-suited to the tasks performed. Raw material that was rarely seen in other tool classes, including the coarser-grained limestone, rhyolite, and quartzite were primarily used for these tool activities, which emphasized edge durability.

At all of the Yamashita sites, the perception of risk must have been minimal given the low rates of raw material conservation. Core reduction was done via multidirectional flake removal and no systematic core preparation or conservation of toolstone was seen. Additionally, only a few cores from Yamashita-2 and Yamashita-3 had undergone possible heat-treatment, suggesting that increasing the quality of the raw material was not of great concern. The debitage analysis also showed a distinct lack of preparation, further indicating that controlled removal and by extension, conservation of toolstone was not of concern. Yet, the little amount of platform preparation was odd given that the analyses from all of the sites indicated that tertiary flakes were the most common and platform preparation is usually associated with soft-hammer percussion techniques. This may have been a result of the absence of platform data collected from microflakes.

The availability of raw material appears to have remained constant throughout the Puebloan period. Those living at the Yamashita sites thus had open access to raw materials, especially CCS, and access or availability of toolstone was never restricted at any point.

The sourcing of several pieces of obsidian identified at least five different sources of obsidian. The locations of two of these sources were close enough that obsidian likely washed down from the Kane Springs sources into the valley or was collected by valley inhabitants themselves via direct or embedded procurement strategies. Other obsidian sources were located to the northeast, which is in accordance with other networks of trade oriented in that direction (Lyneis 1995). Obsidian from that area would have been traded by VBP populations in the upland area to the Moapa Valley, possibly for various goods such as ceramics, shell, turquoise, and cultivated goods.

3. What do the tools and debitage reveal concerning occupation duration at the Yamashita Sites and how did occupation duration affect tool types?

The data collected from the lithic assemblage at the Yamashita sites concerning occupation duration is somewhat contradictory with regard to core reduction strategies and the use of expedient technology. Risk management strategies theoretically should not have been prominent in the lithic technology if occupation duration directly impacted the chipped stone technology, particularly as the occupants of these sites were primarily sedentary (Lyneis 2012).

The cores from the Yamashita sites demonstrated that little preparation was done before removing flakes. Core reduction was also mostly done via multidirectional flake removal, which suggests expedient core technology. Yet, very few cores were recovered from the Yamashita sites. Core to biface ratios generally increase with sedentism (Bamforth and Becker 2000), but all of the Yamashita sites had low core and high bifaces ratio rates. Formal biface use did not decrease as expected. This is unusual and occupation duration did not appear to be directly impacting the chipped stone assemblages in this way. Additionally, early stage core reduction was not common at the sites. The debitage supported that early stage core reduction was rare as primary flakes were not numerous, suggesting that instead of early stage core reduction occurring on-site, it was taking place off-site.

The Yamashita sites also do not have a high number of expediently designed tools. As occupation duration increases, there is an expectation of a reduced level of investment in tool production and maintenance (Parry and Kelly 1987). This is not seen at the Yamashita Sites. Formal biface technology accounted for the majority of the chipped stone assemblages.

Discard of tools is also more common at sedentary sites than in more mobile groups, which tend to favor maintainable tools. The HRI values of projectile point types were assessed on 63 projectile points across the sites. The results indicated that these tools did not have high resharpening rates, but only exhibited moderate retouch. Neither certain point types nor specific kinds of toolstone exhibited greater levels of resharpening values than others. This was unusual given the high rates of formal biface technology at the sites. The rates of broken discarded tools also were noted to see if occupation duration affected the site assemblages. Distal ends from finished bifaces were more common in the assemblages than the number of basal fragments or hafting elements of projectile points, suggesting that re-use of basal fragments was likely common and distal ends were removed or discarded on-site frequently.

Conclusion

Risk is usually mitigated in different ways based on the level of economic concern. If risk is perceived as high, then energy will be expended during the initial tool design and in the maintenance of stone tools. The chipped stone assemblages from the Yamashita sites showed that persistent chipped stone technological design choices were implemented in the production of stone tools. These design choices run somewhat contradictory to the expectations found within the corpus of lithic technology research regarding increased sedentism and an agricultural subsistence focus. Simply, the great quantity of bifaces at these sites is odd. As bifaces are usually tools associated with risk-management, they are designed to be dependable and are time-intensive to produce. The abundance of raw material in the Moapa Valley contradicts their continued use at the Yamashita sites. This organization of technology may suggest that social conditioners of tool manufacture superseded environmental and economic choices involved in tool design at these sites. The bifaces may have been designed as a general cutting and slicing tool and performed well. Modification to the toolkit and the addition of increased expedient technology and a more diversified tool assemblage may have been deemed unnecessary regardless of the sedentary conditions.

The high proportions of projectile points are admittedly somewhat anomalous. More faunal data or use-wear analysis may be necessary to sufficiently understand why such large quantity of hunting technology occurred at the Yamashita sites. Additionally, more attention and a comprehensive data collection of other VBP chipped stone in the lowland area could provide additional data to determine whether other sites in the area have chipped stone assemblages similar to the Yamashita sites. Tool assemblages from this area would also benefit from additional lithic studies, particularly those focused on microscopic use-wear analysis. Further examining the use-wear on bifaces and projectiles at the Yamashita sites and other sites in the region would provide additional insight into the activities that these tools were used for and if any difference in activities can be assessed in the various stages of unhafted bifaces.

More research in the region of chipped stone assemblages at VBP sites, including heat-treatment studies to better understand the properties of chert in the area, obsidian sourcing to continue to explore procurement strategies and trade networks, and other technological organization studies may yield further insight into lithic technology into the area.

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EDUCATION

2015 — M.A., Anthropology, University of Nevada, Las Vegas, Department of Anthropology, emphasis in Archaeology
Thesis: *Chipped Stone Analysis of the Yamashita Sites in Moapa Valley*, *Nevada: A Technological Organization Approach*.

2010 — B.A., Anthropology, University of Nevada, Las Vegas.
B.A., English, University of Nevada, Las Vegas.

EMPLOYMENT

2011-present — Desert Research Institute, Las Vegas, NV

Graduate Assistant: Includes fieldwork, curation facility tasks, and report writing for cultural resource projects.

Archaeological Technician: Conducting survey, monitoring, and recording activities at the Nevada National Security Site related to prehistoric and historic cultural resources.

2013 — Desert National Wildlife Refuge, Las Vegas, NV

Archaeologist (U.S. Fish and Wildlife Service): Included conducting archaeological surveys, site identification, and site evaluation independently and with another staff archaeologist using standard archaeological techniques for compliance with Section 106 of the NHPA. Researched, prepared, and completed archaeological documents (letters; agreement documents; site, project, and evaluation reports) for compliance with the NHPA and academic-oriented research using forms and formats acceptable for the SHPO. Updated site forms and supplementary site files. Created a master artifact catalog for the Refuge. Supported collaborative project proponents, partners, FWS staff, volunteers, tribes, and other archaeologists.

2012 — Southwest Archaeology and Lithics Lab, Department of Anthropology, UNLV.

Lithic Analyst: Included lithic analysis of a Mogollon pithouse assemblage from La Gila Encantada in NM.

Lithic Analyst: Included selective sampling debitage analysis from the Harris Site in NM.

Lab Technician: Included cataloguing artifacts from the site assemblage of the Harris Site in NM.

Lab Technician: Included report write-up of the groundstone analysis to assess activities at the Yamashita sites in NV.

ARCHAEOLOGICAL PROJECTS

2012 Volunteer on the House 47 field project in Moapa Valley, NV. Directed by Dr. Karen Harry. Department of Anthropology, UNLV.

Volunteer on the Shivwits Research Project in the Grand Canyon-Parashant National Monument, AZ. Directed by Dr. Karen Harry, Department of Anthropology, UNLV.

2010 Student at the Harris Site Field School in the Mimbres Valley, NM. Harris Site. Directed by Dr. Barbara Roth. Department of Anthropology, UNLV.

2009 Student at a 2009 UNLV Field School in Zzyzx, CA. Directed by Dr. Barbara Roth. Department of Anthropology, UNLV.

ACADEMIC SERVICE

2012 Summer Advanced Gifted Education Program, UNLV

Teaching Assistant: Included assisting in designing a curriculum for a class of junior high school students taking a college-level Anthropology course for credit. Emphasized a four-field approach of anthropology. Assisted the teacher and led review discussion, as well as leading activities of hands-on demonstrations of archaeological methods and tasks.

Department of Anthropology, UNLV

Graduate Assistant: Included assisting faculty in anthropology classes by grading examinations, writing test questions, and proctoring exams. Held regular office hours for students. Did archaeology-based laboratory work, including writing unit descriptions.

Volunteer: Instructed lab volunteers on lithic analysis techniques.

2010 Department of Anthropology, UNLV

Intern: Included archaeological laboratory work concerning the cataloguing of cultural resources for curation of artifacts from La Gila Encantada.

President, UNLV Anthropology Society: Acted as the head of the UNLV Anthropology Society. Organized and disseminated information to undergraduates and interested parties about events, workshops, and academic activities related to the field.

Committee Member, UNLV Anthropology Society: Acted as scholarship committee member to determine recipients of the Anthropology Society's yearly awarded scholarships (up to $500) to undergraduates or graduates.

TECHNICAL REPORTS

2014 Lauren W. Falvey and **Tatianna Menocal**. *Curation Compliance Annual Progress Report FY 2014*. Letter Report No. 090214-1, Desert Research Institute, Las Vegas.

2013 **Tatianna Menocal**. *A Class III Cultural Resources Inventory of the Proposed Jackass Flats Road Reconstruction, Area 25, Nevada National Security Site, Nye County, Nevada*. Cultural Resources Reconnaissance Short Report No. 080813-1, Desert Research Institute, Las Vegas.

POSTER PRESENTATIONS

2012 **Tatianna Menocal**. *Obsidian Sourcing of Artifacts from the Yamashita Sites*. Great Basin Anthropological Conference 33rd Meeting.

Tatianna Menocal and Lauren W. Falvey. *Evidence of Historic Footwear in Southern Nevada*. Society of American Archaeology 77th Annual Meeting.

GRANTS AND AWARDS

2013 Eleanor F. Edwards and Max Olswang Scholarship Fund in the amount of $384.

Patricia Sastaunak Scholarship in the amount of $2,500.

2012 Graduate and Professional Student Association Grant in the amount of $350.

Graduate and Professional Student Association Grant in the amount of $550.

UNLV Anthropology Society Scholarship in the amount of $200.

PUBLIC OUTREACH

2013 Guest classroom speaker on archaeological methods for the Dawson College Bound summer program.

Volunteer at the Las Vegas Science and Technological Festival at the USFWS booth to provide conservation information and hands-on activities for parents and children in the community.

2012	Volunteer at the Department of Anthropology Open house to provide discussion and hands-on archaeological laboratory activities to undergraduates and community members.
2011	Volunteer at the Marjorie Barrick Museum to assist in cleaning and organizing archaeological displays.

MEMBERSHIPS

Member. Nevada Archaeological Association (NAA)
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